A window open on the world

The UNESCO Courier

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THE UNIVERSITY OF MICHIGAN
MAY 13 1966
PERIODICAL READING ROOM

PERUVIAN CHRONICLES IN CLAY

TREASURES OF WORLD ART ❸

The lonely world of Giacometti

These soaring, rough-pitted figures are the work of Alberto Giacometti, the great Swiss sculptor, who died in January at the age of 64. Giacometti gained international fame only in his later years. His sculpture has been called tree-like, and offers a curious combination of togetherness and loneliness. He came to Paris in 1922 and studied under Bourdelle, himself a pupil of Rodin, and produced many works, although he destroyed a great number which failed to satisfy him. Only about 200 of his sculptures exist today, along with his paintings and drawings.

Maeght Foundation Collection, St Paul de Vence. Photo © Maeght Foundation-Claude Gaspari

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Page

4 **EUROPE'S EXPANDING NUCLEAR RESEARCH**
By M. S. Wilde

10 **PERU'S COASTAL DESERTS**
Land of three great cultures
By Peveril Meigs

12 **PERUVIAN CHRONICLES IN CLAY**

16 **LIBRARIES FOR CHILDREN ONLY**

20 **THE AMBER ROUTES OF ANTIQUITY**
By Wladislaw Grzedzielski

23 **THE TRANSMIGRATION OF SHOALS**
A new Mediterranean fishing problem
By Daniel Behrman

25 **ANCIENT SCRIPTS FROM AFRICA**
By Dmitri A. Olderogge

30 **GREAT MEN, GREAT EVENTS**

32 **FROM THE UNESCO NEWSROOM**

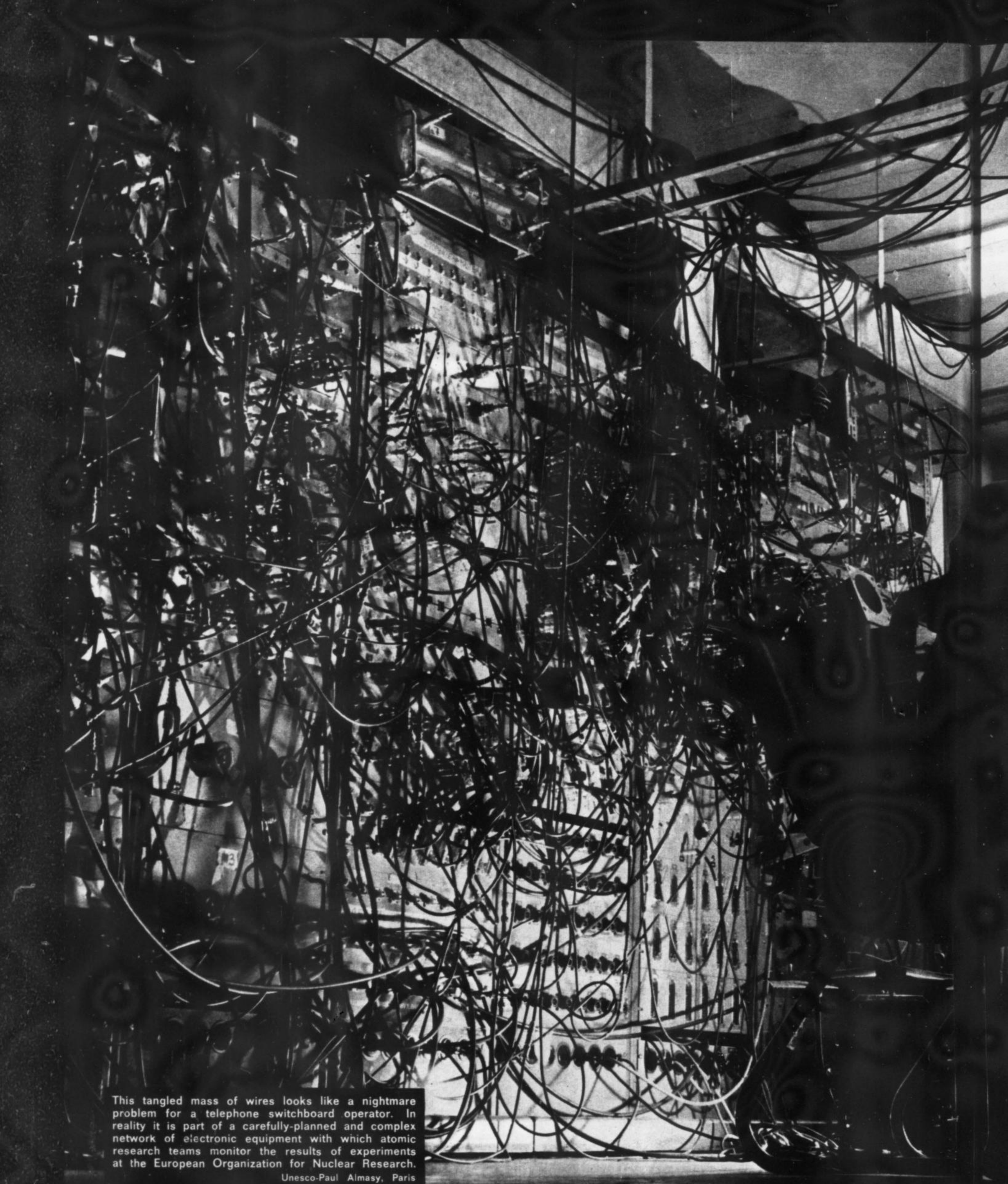
34 **LETTERS TO THE EDITOR**

N° 3 - 1966 MC.66-1-211 A

Drawing © Arturo Jimenez Borja

Cover photo

The Indian fishermen of northern Peru still use reeds to make simple skiffs which they call "little reed horses." They inherited this tradition from their distant ancestors, the Mochicas, as is shown by this Mochican pottery decoration: a stylized drawing of a reed vessel with bow and stern fashioned into dragon heads. The Mochicas were master ceramists who revealed every detail of their lives in fine, realistically moulded pottery. **(see page 12).**



This tangled mass of wires looks like a nightmare problem for a telephone switchboard operator. In reality it is part of a carefully-planned and complex network of electronic equipment with which atomic research teams monitor the results of experiments at the European Organization for Nuclear Research.

Unesco-Paul Almasy, Paris

EUROPE'S EXPANDING NUCLEAR RESEARCH CENTRE

by M. S. Wilde

To probe deeper and deeper into the infinitely tiny world of the atom, science has paradoxically to design and build larger and larger tools—giant accelerators producing beams of high energy particles that can "prise open" the close-knit structure of atomic nuclei. CERN, the European Organization for Nuclear Research, in Geneva, which was created under the auspices of Unesco in 1952, has decided to build a new type of atom smashing machine, 50 times more powerful than any existing accelerator. What this will do and why CERN foresees the need for a still more colossal one within the next decade are explained in this article.

A peaceful penetration into France from Switzerland has been made by CERN, the European Organization for Nuclear Research, to find space to build a new type of atom smashing machine which can reach energies more than fifty times those produced by the biggest conventional particle accelerator in the world today, which is at Brookhaven, U.S.A.

On a 100-acre site in Switzerland, on the French border just outside Geneva, CERN now has an accelerator called a Proton Synchroton with an energy of 28 GeV (28,000 million electron Volts), the second most powerful in existence.

This machine accelerates proton particles to speeds nearly equivalent to that of light (186,000 miles per second), which then smash against atomic nuclei in detectors. However, these latter are stationary; and because of their resistance or recoil, three-quarters of the original force is lost, so that the impact represents an energy of only 7 GeV.

The same, of course, holds true for all other accelerators

CONT'D ON NEXT PAGE

CERN

CERN is a European co-operative enterprise in which the skills and resources of 13 European countries are being applied to experimental and theoretical nuclear research of a non-military nature. The results of its work are made available to all countries throughout the world. Over 350 fellows and visiting scientists come to stay at CERN for anything from two months to two years, so that it also plays an important role in the education of the new generation of scientists. Many other scientists visit CERN to discuss and describe the most recent discoveries in nuclear research. Above, an international group of physicists carries on a discussion and (facing page) a visiting scientist lectures on atomic structures at CERN.

EXPANDING NUCLEAR RESEARCH *(Cont'd)*

Peaceful collisions beneath the frontier

of the same type, such as the one of 33 GeV at Brookhaven, and the one of 10 GeV at Dubna, near Moscow, U.S.S.R. It is also one of the reasons why nuclear physicists call for the construction of ever larger—and more costly—conventional accelerators; one of 70 GeV is now under construction at Serpukhov in the U.S.S.R., while one of 200 GeV is under contemplation in the United States, and another of 300 GeV by CERN somewhere in Europe, but not at Geneva where there is no suitable site for it.

But some years ago, and practically simultaneously, a team of physicists from Stanford and Princeton Universities in the U.S.A., a group of Soviet physicists at Novosibirsk, and another group, a mixed Italian and French team, hit upon the same brilliant idea. Why not have two beams of particles accelerated to about the equivalent of the speed of light collide with each other in an intersecting storage ring? In this way, energies could be produced far exceeding those of smashing into any stationary target. However, at Stanford University it took six years of trial and error to put the idea into practice. The French and Italians, working at Frascati, Italy and Orsay, France have been experimenting with a small storage ring called "Ada" since 1962. In the Soviet Union, physicists have built and operated intersecting storage rings for electrons and positrons.

Once assured of its probable success, CERN decided to put the collision principle into practice on a large scale. Its Council has approved the construction of such a ring in an underground circular tunnel, using protons, the acceleration of the particles being provided by the existing Synchrotron, which will feed beams at about the speed of light into the ring at two different points and in opposite directions. There will be eight points of intersection at which collisions can be made to occur, and their results observed, at a force for which a conventional accelerator of 1,700 GeV would be needed—at present a practical impossibility.

The ring, which will have a diameter of about 330 yards (302 metres) will be equipped with powerful concentric magnets to guide the beams. Its estimated cost is 64 million dollars (£22,500,000), which will be spent over the next six years. The money will be provided by the thirteen member states of CERN: Austria, Belgium, Denmark, France, the Federal Republic of Germany, Greece, Italy, the Nether-

© Paul Almasy, Paris

lands, Norway, Spain, Sweden, Switzerland and the United Kingdom (1).

Since there was not enough adjacent room on the Swiss side of the border to construct it, CERN has leased another 100 acres (40 hectares) of land, belonging to the French State, across the border in the foothill country of the Jura mountains. The lease covers a period of 99 years and is renewable. It is at a "peppercorn" rent of ten francs (not quite a pound sterling) per annum. However, in order not to interfere with the provisions of the 1953 Convention which established the European Organization for Nuclear Research in Switzerland, the new area across the French frontier will be completely fenced off, so that all entrances and exits will be on the Swiss side. The agreement handing over the French territory to CERN was signed at a ceremony on September 13, 1965.

With this new project now virtually under way, with the main object of achieving high energy collisions between particles, the question naturally arises why it should be necessary to build bigger and more powerful accelerators of the conventional static target type as well. The main reason is that only collisions between protons and protons can be investigated in the new storage ring, which is certainly not enough to explore properly the new world of subnuclear particles and forces now opening up. It does not allow the use of "probes" of mesons and other particles which make up the large majority of today's experiments.

"This is why", says a recent CERN report, "everyone is agreed that a 300 GeV Proton Synchroton is essential for Europe within the next decade, since it will generate the whole range of different "probes" the high-energy beams of many kinds of particles—which will be needed. Nevertheless, just as the first look into this new world was made through the window of cosmic rays, so the Intersecting Storage Rings—which provide collisions similar to those of cosmic rays, but with very much larger intensity and much better defined and controlled—are to be seen as a window into the possible world which lies behind the complexity of today's high-energy physics.

"The proton-proton interaction has always been a res-

CONT'D ON NEXT PAGE

(1) Three other countries, Poland, Turkey and Yugoslavia, have observer status with CERN.

Nine countries offer 19 sites for future accelerator

pectable part of nuclear research, and the Intersecting Storage Ring can provide for this part of the physics of 1,500 GeV (or even bigger) accelerators at a comparatively small cost—about 5 per cent of that of the equivalent Proton Synchrotron."

Nevertheless, there are risks. The CERN report adds: "Firm guarantees cannot be expected: any important step into the unknown—whether it be the CERN Proton Synchrotron ten years ago or the Intersecting Storage Ring now—must ultimately be a scientific act of faith, since experience shows that the questions that seem important now are often resolved in other ways before a new machine starts operating, and that its most valuable contributions to knowledge are never foreseen at the start.

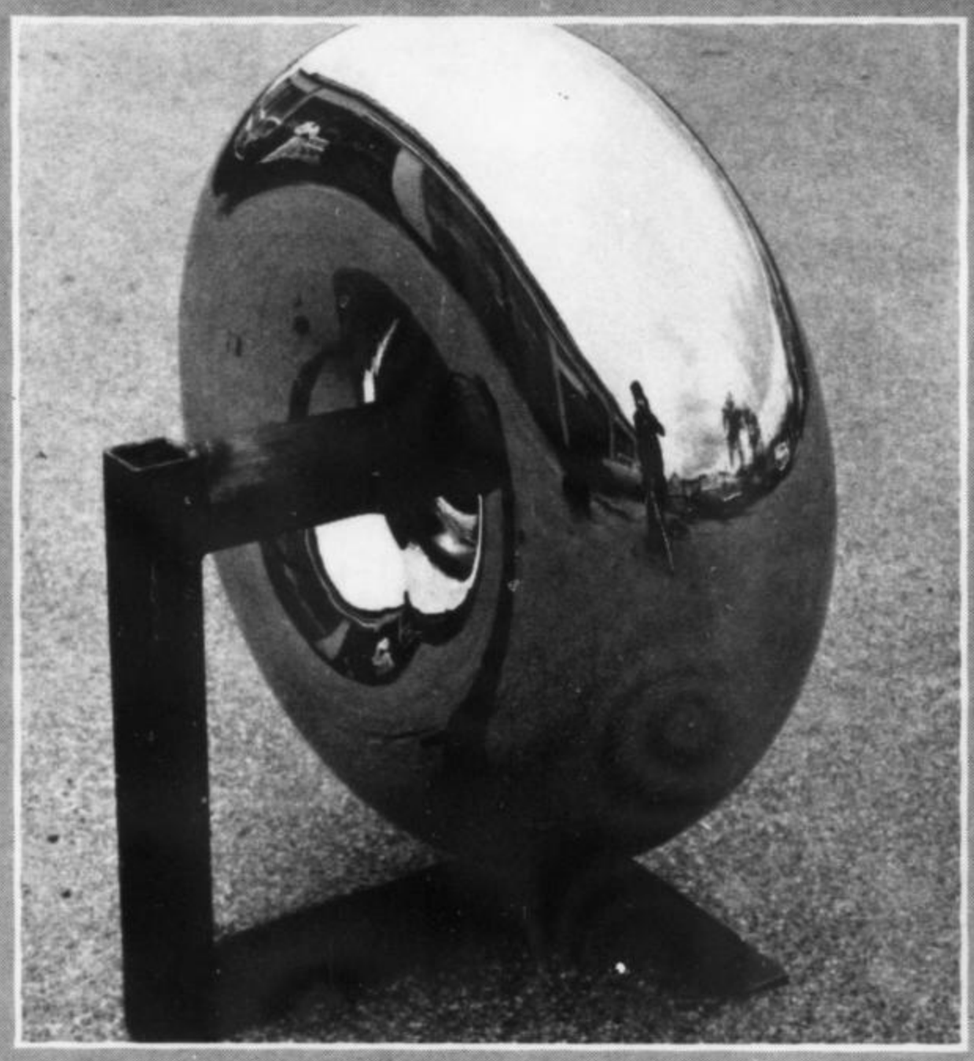
"It is reasonable that CERN should carry for the whole of Europe risks of this kind, which would not be acceptable to countries individually, provided that they do not endanger the running of CERN itself. The amount at stake can perhaps be judged from the fraction of the CERN budget—about 20 per cent—which the operation of the Intersecting Storage Ring will represent after 1970. The fraction of the *total* European expenditure (on nuclear physics) will, of course, be smaller still."

There is also the time factor to consider. If all goes well, the new Intersecting Storage Ring should be in operation within five to six years. The construction of the colossal 300 GeV conventional accelerator, in a circular tunnel with a diameter of one and one-half miles (2.4 kms) on the other hand, has not even reached the planning stage. When finally completed it would, of course, be the largest of its kind in the world for many years to come; even the U.S. is only contemplating construction of a similar machine of only two-thirds this size and energy.

ABOUT a year ago, CERN asked member states to offer sites for the new giant accelerator and the response was gratifying; nineteen possible sites were put forward by nine member states out of thirteen. All of these had to be investigated for suitability and, by the end of 1965, there remained for consideration the following: Goepfritz in Austria, Focant in Belgium, Le Luc in France, Kongsvinger in Norway, El Escorial in Spain, Uppsala in Sweden and Mundford in the United Kingdom. In addition there are two sites still under review in the Republic of Germany: Drensteinfurt and Sarrelouis; and another two in Italy: Nardo and Doberdo.

Geological, geotechnical and hydrogeological studies are continuing at all these places, as well as investigations into local industrial potential, the availability of manpower, housing, schooling, etc. It is expected that complete reports on ten sites will be placed before the CERN Council when it meets next June, the other nine by then having been eliminated.

Not until then will it be possible to make a final selection. Thereupon the money for construction, estimated at about 150 million pounds sterling ($ 420 million), will have to be found. Thereafter it will take at least ten years to build, so that in no circumstances could the 300 GeV accelerator be completed before 1976-77.

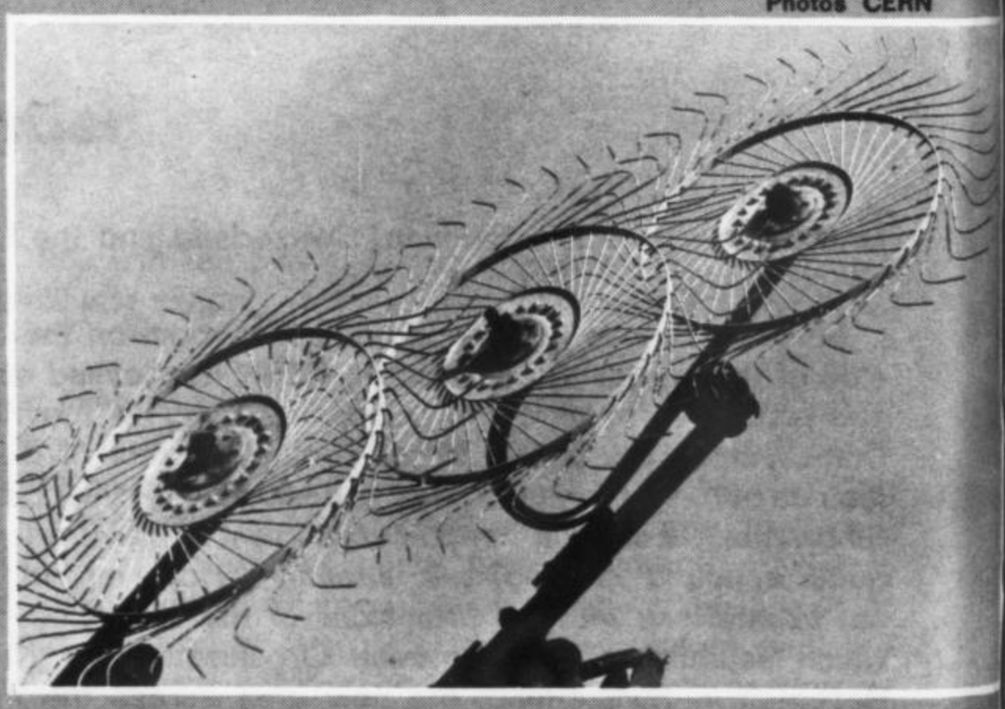


1

PUZZLE PHOTOS

These are playthings of grown men. With them they learn a great deal about the structure of the universe. You probably can't guess what each contraption is for—except for one. Answers on page 32.

Photos CERN



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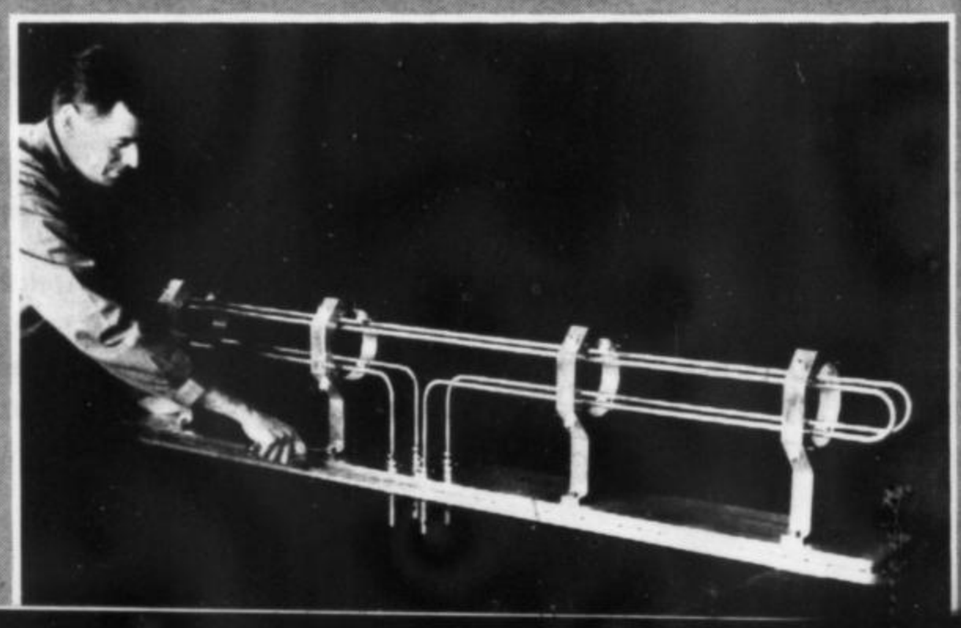

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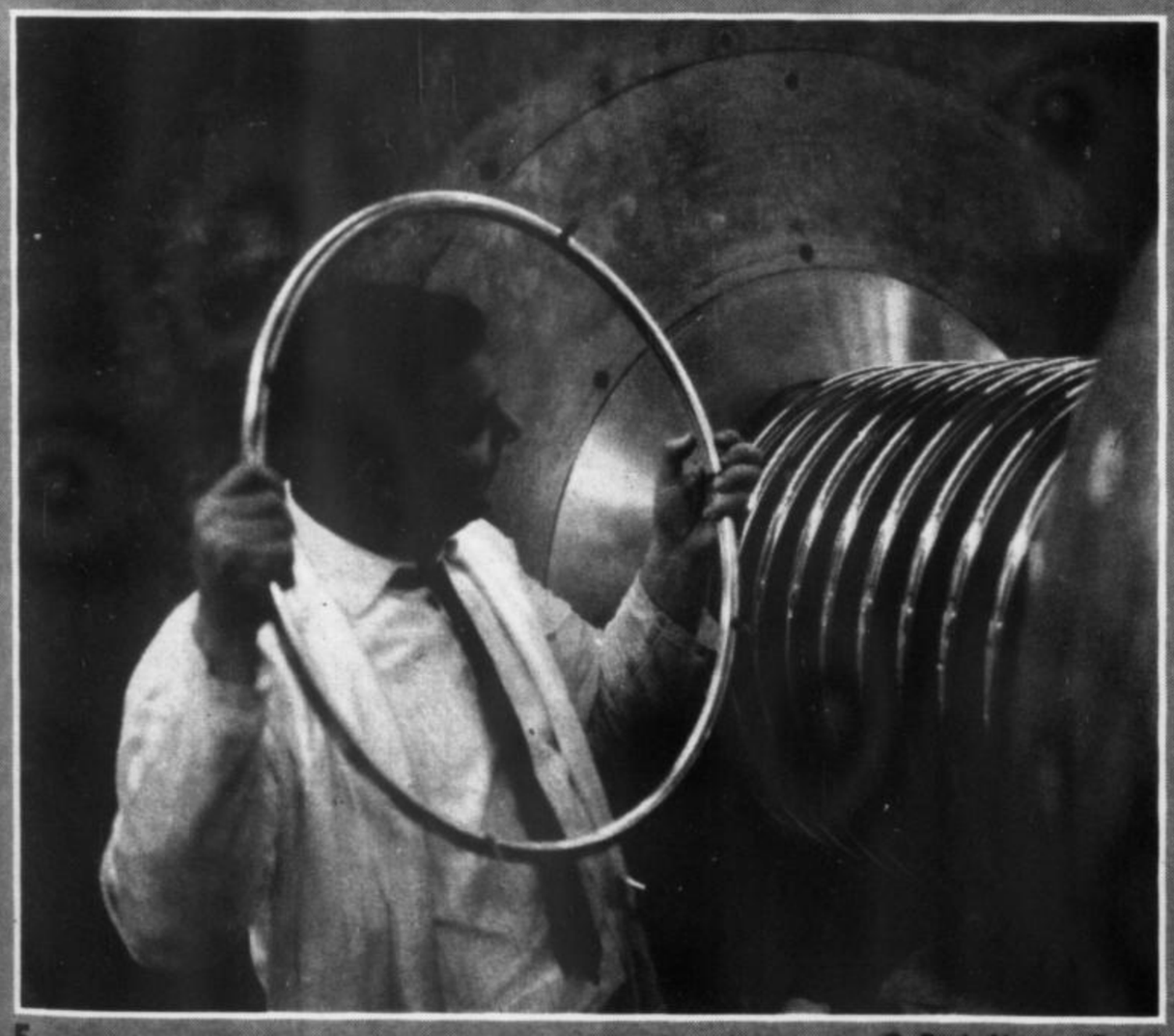

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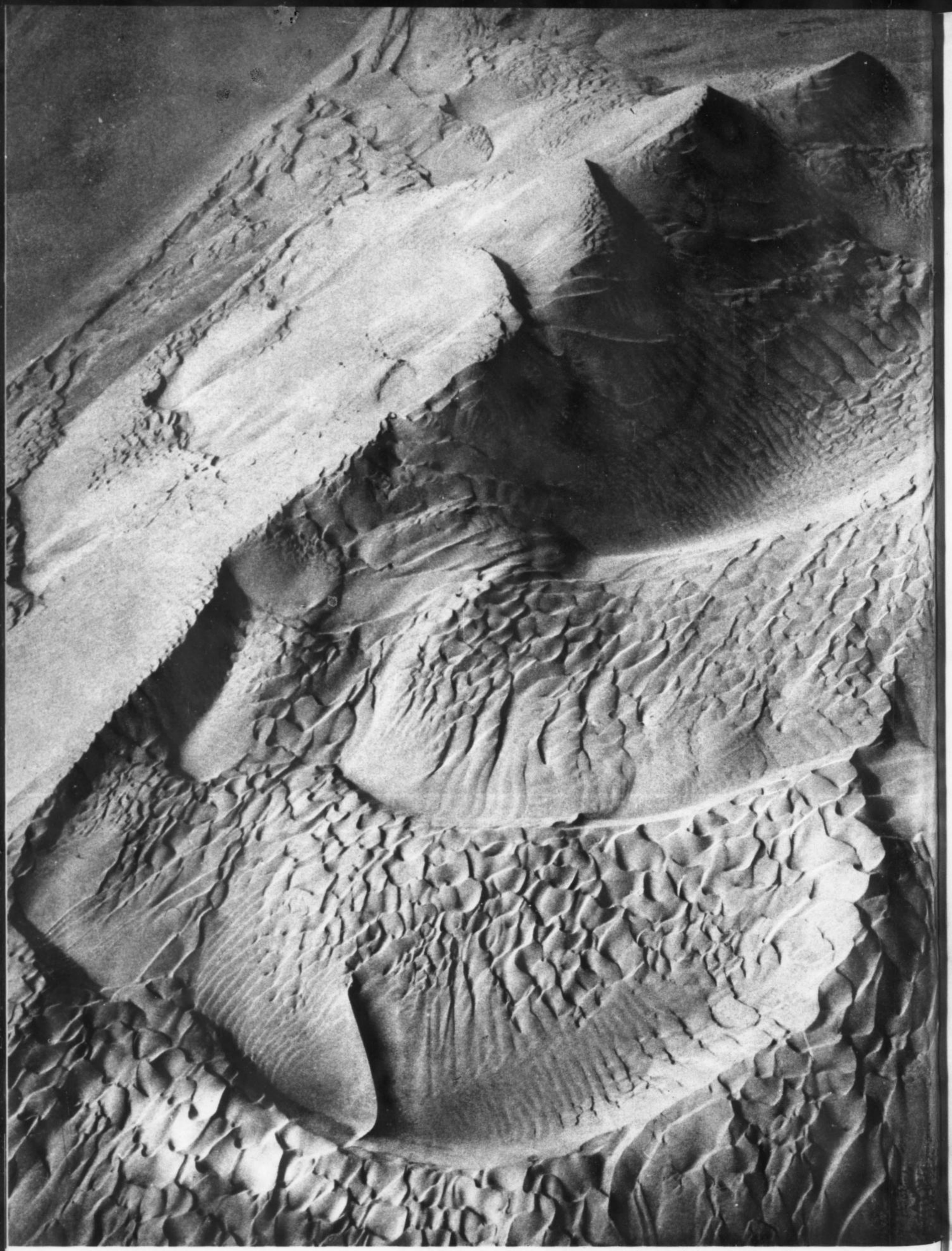
CERN



© Paul Almasy, Paris

Giant sand dunes in the coastal desert of the province of Ica, southern Peru.

PERU'S COASTAL DESERTS

Land of three great cultures

by Peveril Meigs

Deserts reach down to the sea along some 18,500 miles of the world's coastlines. They cover vast areas in Mauritania, South Africa, Australia and California, form an unbroken chain from north-western India to the Red Sea and follow the west coast of South America for well over 2,000 miles. Coastal deserts have special characteristics whose study is of great importance to arid zone research. The proximity of the sea and the possibilities of desalting sea water on a large scale for domestic and industrial needs, and perhaps eventually for irrigation, also give new importance to these hitherto neglected areas. This is made clear in a recently published report on the inter-continental survey of coastal deserts (1) carried out for Unesco by Dr. Peveril Meigs, chairman of the Arid Zone Commission of the International Geographical Union. In the article below, which is taken from this study, Dr. Meigs describes Peru's coastal desert, historically and economically one of the most interesting in the world. An international conference on coastal deserts is to be held in Peru next year under the auspices of Unesco and the International Geographical Union.

(1) "Geography of Coastal Deserts", Unesco, $.6.50; 33/-(stg.); 23 F.

Bordering the Pacific Ocean for 2,300 miles at the base of the Andes stretches the longest west-coast desert in the world. The southern part of the desert, in Chile, is known as the Atacama. The northern part, in Peru, has no accepted inclusive name, unless it be simply *La Costa* (the coast).

Though the land offers little unity, the sea and its associated climatic and biologic influences are strikingly uniform along the entire coast. Directly off shore is a belt of water abnormally cool for the latitude. Although associated with the northward-flowing Peru Current or Humboldt Current, the cold water belt consists actually of upwelling water from the deep layer of the ocean.

Lowest temperatures of about 60° F. are found within a mile of the coast, and westward they rise steadily for at least 100 miles, to a level about 16° F higher. The temperature is remarkably uniform along the whole coast to Punta Pariñas, where the continent reaches its westernmost extent within less than 5° latitude of the equator.

As a result of the cool water off shore, and the prevalence of south-westerly winds, the littoral has a strikingly mild and uniform climate. The coolest month usually August, averages above 59° F., while the warmest month, January or February, is from 68 to 81° F. At such temperatures, practically all temperate and subtropical crops are possible, provided water is available. As in other west-coast deserts, the cool water off shore gives such stability to the air that rainfall is slight or, in some years, non-existent.

But in winter, from June to October, there is a strong development of low cloud, of a type locally famous under the name *garua*. The garua, a fine mist, forms a layer about 1,000 ft. thick, with its base between about 1,000 and 3,000 ft. above sea level. It furnishes enough water to support a growth of vegetation on any hills or mountains within its reach near the coast. In addition, the garua shuts out the sunlight for most of the time, resulting in chilly, gloomy conditions, and retarding evaporation in the land below it.

The cool water off shore has other profound consequences for human activity. The upwelling water supports a prolific growth of plankton, which in turn feed fish of many species and tremendous numbers. From the earliest times the fish have been an important source of food for the Peruvians. In addition, they support many millions of sea birds that crowd the desert islands up and down the coast.

These birds, of which a type of cormorant, the guanay, is by far the most numerous, nest on the islands, where their droppings form the guano accumulations that constitute one of the most valuable resources of Peru. Such accumulations are possible only in deserts, where there is virtually no rainfall to erode the deposits.

Although the guano deposits were used by the ancient Indian civilizations to maintain the fertility of the irrigated lands of the coastal desert in Peru, their great value was only "rediscovered" in the mid-nineteenth century, at which

CONT'D ON PAGE 14

PEVERIL MEIGS *is a U.S. geographer who has specialized in arid zone problems for many years. He is the author of "Distribution of Arid Homoclimates", published by the United Nations in 1952. The collection of maps specially compiled for this work also appeared in the Unesco study "Hydrology of the Arid Zone" (1953).*

Sea eagle from a Mochican pottery design is one of many birds, plants and animals of the Peruvian coastal desert portrayed by Mochican artists, whose works reveal an equal mastery of painting and pottery. Animal portraits were also stylized and sometimes grouped in skilful geometrical designs like the sea eagle frieze shown on facing page. Below, painted vase topped by figure of owl god.

© Hyokichi Sato-Yoshitaro Amano, Tokyo

HOW A TINY SEA SNAIL BECOMES A DRAGON

A

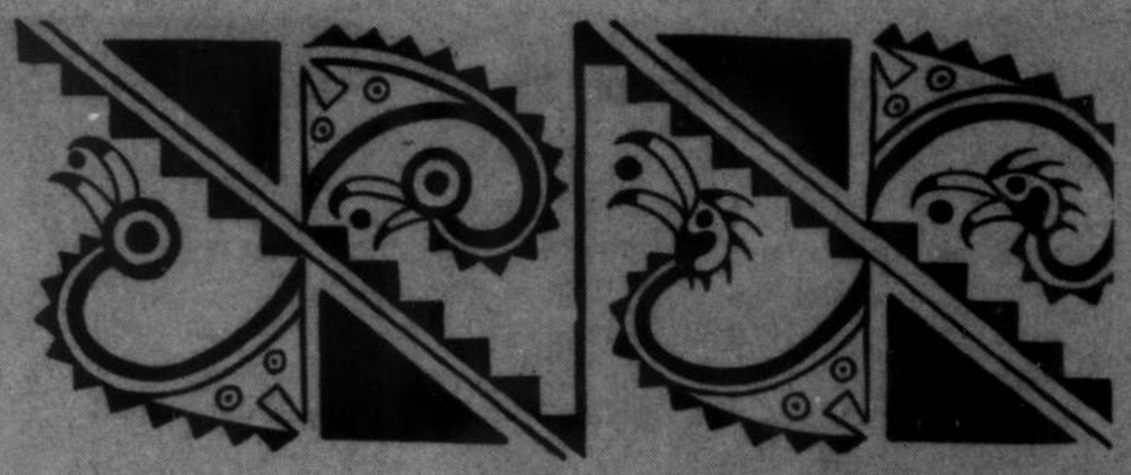
B

C

D

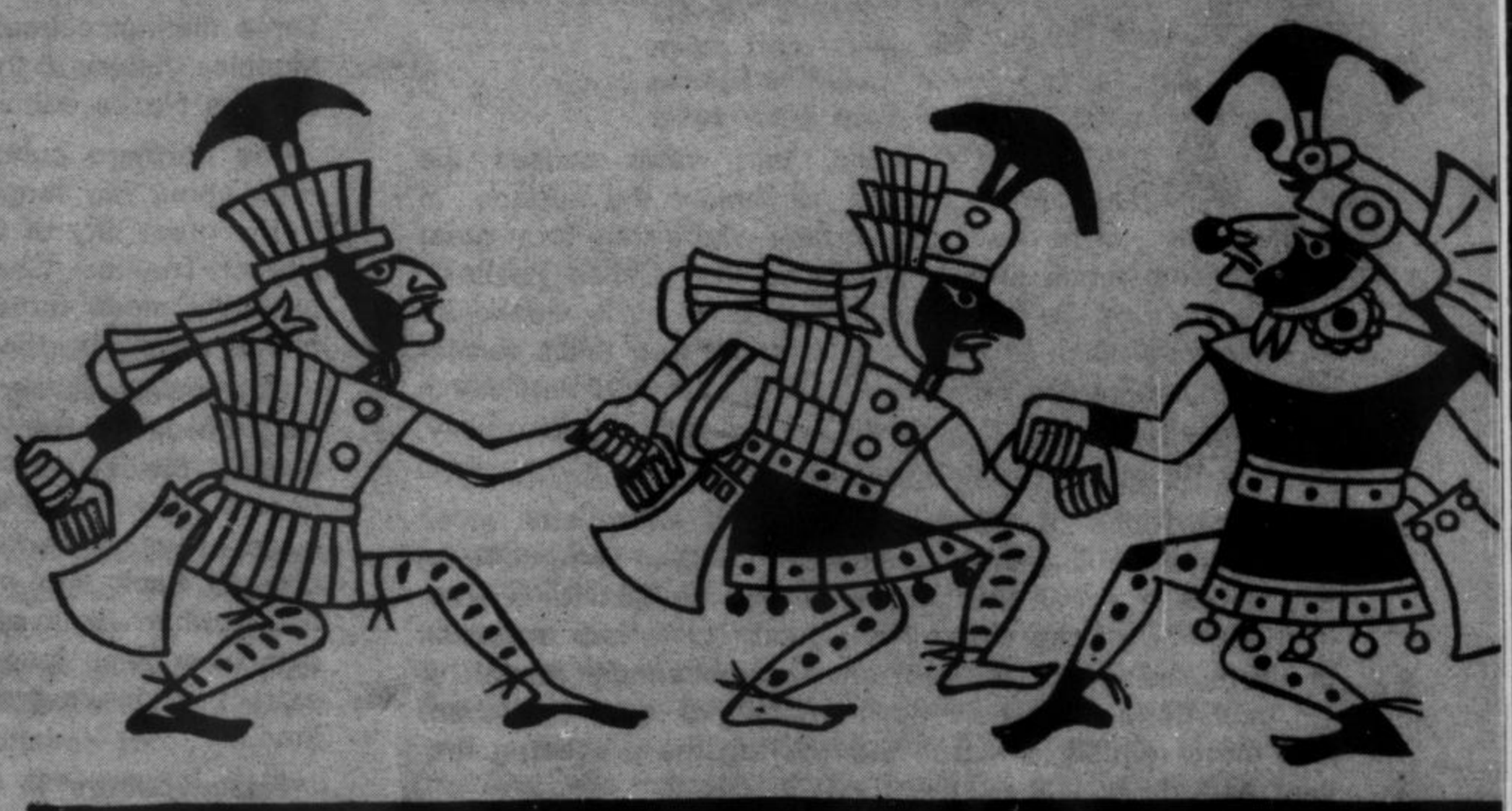
The humble sea snail is often depicted on Mochican pottery and sometimes, as here, undergoes a startling transformation at the hands of imaginative Mochican artists. A) Realistic drawing of sea snail. B) The mollusc has grown feet and a serpentine tail; a forked tongue flicks from between its jaws. C) A carapace replaces the snail's shell, a second head grows from its tail and it has acquired clawed feet. D) A fabulous monster with scaly body and mighty fangs. The metamorphosis is complete.

PERUVIAN CHRONICLES IN CLAY



Over 15 centuries ago, long before the rise of the Inca Empire, a remarkable civilization flourished on the northern coast of Peru. Its people, the Mochicas, excelled as ceramic artists, and have left us a fascinating record of the world they lived in. These master potters modelled everything that captured their imagination—men and animals, birds, fruits, vegetables and the humblest objects of everyday life (see "On Looking into a Mochican Urn", Unesco Courier, Feb. 1955). They were chroniclers who painstakingly recorded in clay the most intensely human aspects of life as well as the customs, beliefs and social structure of their ancient civilization. Whether modelling in clay or decorating vases in red and brown colours on a cream-yellow background, Mochican artists displayed an astonishing degree of artistic perfection and unbridled imagination. The Peruvian archaeologist, Arturo Jimenez Borja, has written a special study on the significance of Mochican ceramics, "Cuentos Peruanos" (Peruvian Tales), from which the decorative designs on these pages are taken.

Mochican hunter waving a paddle, chases a seal towards a suitable killing ground, where he will finish off the animal with a heavy club. Sea shells and starfish show that the hunt is taking place on the seashore.



Warriors' dance. The tintinnabulation of the bells attached to the ceremonial costumes helps the dancers to keep the rhythm. Dances of all kinds are depicted on Mochican pottery; paintings reveal use of drums, reed pipes, tambourines and bells.

Drawings © Arturo Jimenez Borja, Lima

Less inhabited than in Inca times

time the guano had accumulated to depths of as much as 150 ft. on some islands. In the ensuing feverish "guano rush", millions of tons were shipped to Europe, and the deposits were mined out in a few years, with no thought given to conservation of the sea fowl that made these riches possible.

During the last fifty years, however, the Peruvian Government, through the *Compania Administradora del Guano*, has sponsored the necessary conservation measures to encourage the multiplication of the guanayes, and the guano, now treated as a perpetual annual crop, yields more than 300,000 tons per year. Not only are the fifty or more guano islands set aside as bird sanctuaries, with guano harvesting permitted only at certain seasons, but positive measures are taken to encourage multiplication of the birds. Thus at some localities low walls are built to prevent the young birds from falling over the cliffs into the sea.

To expand the overcrowded nesting areas, starting in 1946 the Government has walled off peninsulas of the mainland so that birds can breed without molestation by animal predators. In effect, this has already created ten or more new guano "islands", most of them on the southern coast where true islands are lacking.

In recent years a new threat to the guano industry has appeared. The vast schools of anchovies that make up the chief food of the birds are now being harvested directly by fishermen through mass methods, to be dried, ground up, and sold as fresh meal for poultry and cattle feed. One of the big questions is the extent to which direct harvesting of the anchovies can be made without upsetting the ecologic balance that makes possible the production of guano. Already the Government has placed restrictions on this type of fishing.

A complicating factor in the ecologic balance enters the scene at irregular intervals: a warm countercurrent from the north, known as the *Niño* (Christ Child) because it appears about Christmas, when the solar heating system, along with its intertropical air masses, has moved south of the equator. The Niño annually flows southward 5° to 8° from the equator, over-riding the northern part of the Peru Current near the coast.

Occasionally, usually at intervals of seven or more years, the Niño thrusts much farther south, sometimes even reaching Pisco, 14° S., where it is finally deflected seaward at the Paracas Peninsula.

ABNORMALLY warm, this water causes the plankton to remain far below the surface, in cooler water, or to die at the surface where they form great masses sometimes known locally as the "Callao Painter". The fish, in turn, die by the millions, and the birds, weakened by undernourishment and the effort of flying much farther then accustomed in search of live fish, sicken and die in such numbers that the guano crops drop disastrously, building back to normal only after a period of some years.

The presence of the warm water off shore also gives the air an instability that sometimes results in torrential rain and floods in areas that may have had no rain for a year. In 1925, one of the worst Niño years, Lima had a rainfall of 60 in., as compared with an average annual rainfall of 1.8 in. Along the whole northern half of the coast there was more rainfall in March than during the preceding ten-year period.

The attractions of mild climate, abundant water from the Andes, abundant fish everywhere off shore, vast deposits of guano to maintain soil productivity and nearby mineral deposits were taken advantage of to develop ancient centres of advanced civilization in the coastal desert 2,000 years before the Spanish conquest.

Primitive agriculture may have started in this area as early as 3,000 B.C., with cotton and later maize among the chief crops, though sea food was the chief source of nutriment. From 1225 to 700 B.C., ceramics, textiles, architecture, irrigation and gold-working were developed. From 600 to 350 B.C., beans, llamas as beasts of burden, stone-walled terraces for irrigation, and copper-working entered the picture.

THEN arose one of the greatest American civilizations, which lasted from the fourth century B.C. to the tenth century A.D. Unlike the Egyptian, Mediterranean, and ancient Greek civilizations, the ancient Peruvian cultures were not ancestral to modern European-type culture and consequently have received little attention from Western writers, apart from the specialized academic circles. Furthermore they had no written language. However, they do provide valuable clues to the potentialities of coastal deserts, and they passed on certain economic institutions that still prevail in coastal Peru.

Many details of the material culture and chronology of the great coastal civilization of Peru were obtained from artefacts uncovered by the guano-quarrying between A.D. 1840 and 1880. The early Indians, in the course of their guano-gathering, left behind articles of gold, copper, textiles,, and other materials that soon became buried and preserved under the constant accumulation of guano. We know that arts and crafts reached peaks of excellence, especially in pottery, textiles, and metallurgy in gold, silver, copper and alloys (bronze was never hit upon). Agriculture reached a level never subsequently regained in this region, through the use of thoroughly planned irrigation systems and intensive use of guano.

Although the great civilization extended throughout most of the Peruvian coastal desert, it involved numerous variants in the different irrigated valleys, most of which were separated from one another by sterile stretches of desert. Three distinct subculture areas have been recognized: the Mochica culture in the north, the Lima culture in the centre, and the Nazca culture in the south.

The northern culture was the most extensive, reaching from about Rio Jequetepeque to Rio Casma, and centring in the great city of Chanchan, adjacent to the present-day city of Trujillo. Chanchan, a city of 200,000 people, has probably made more intensive use of sun-dried "adobe" bricks than any other locality in the world.

Great engineering works, including one canal 73 miles long, brought water from the Moche and Chicama rivers to irrigate the alluvial plain of Chanchan. Some of these canals have been rebuilt and are in use today, though large areas of formerly farmed land have not yet been brought back into irrigation. In the Nepeña valley, near the southern limit of Mochica culture, remains of a huge dam have been found. Guano was systematically used to extract maximum production from the intensively cultivated land.

Nazca culture in the south, in the basins of the Rio

© J. Hardouin

Monoliths engraved with bas reliefs of human figures stand at the foot of Mount Cerro Sechin, 250 miles from Lima, the capital of Peru. Ancient stone sculpture is rare in Peru, and these standing stones are one of the mysteries of the old coastal civilizations. Nothing is known about their origin or their significance.

Grande and Rio Ica, lacked the advanced metallurgy of Mochica, but attained unsurpassed levels of excellence in weaving. It had its own distinctive pottery. The Lima culture, in the valleys of the Rios Chancay, Chillón, Rimac, and Lurin, was the most primitive of the three.

In the eleventh and twelfth centuries A.D., the great coastal cultures were overwhelmed by the Tiahuanacan group from the interior. In the thirteenth to fifteenth centuries there was another blossoming of coastal civilization, known as the Chimú culture. Chanchan was a major centre, but other small kingdoms flourished too. Then in 1470 the Inca conquest extended to the coastal desert, and in 1533 Pizarro conquered all Peru and brought to an end the whole highly organized civilization that he found.

The modern cultures, like those of the distant past, still depend upon irrigation agriculture, fishing, guano, and llama travel off the main roads. Cotton and maize remain major crops, but two other chief crops, sugar cane and rice, are post-Columbian in this region. Iron ore and petroleum, unknown by the Mochicas, have been added to the exploited resources of the region. Hydro-electric power from the bordering mountains is another new source of energy. Yet the present-day population of Peru, about 11 million, remains less than that of the Mochica and Inca periods.

FOR CHILDREN ONLY

Children's libraries exist all over the world, but most of them are school libraries or simply sub-departments of public libraries designed to serve adults. Libraries conceived and built to operate as independent units, catering exclusively for children are still rare exceptions. The latest of this kind—and the first in France—opened recently among the red-brick apartment houses in the Paris suburb of Clamart. Recent urban development in this area had raised its population of youngsters, aged four to fourteen, to over 6,000, but little was being done to cater for their leisure time needs. So "La Joie par les Livres," a nonprofit organization for promoting reading, decided to build a comfortable and attractive cultural and recreational centre which would provide books, illustrated lectures and classes in painting, pottery and clay modeling. The centre opened towards the end of last year and within two months over 1,000 children were using it regularly. Our photo story shows some features of the library, whose architecture, equipment and methods combine to stimulate and satisfy the spontaneous interests of young people.

Children come down the stairway from the reading room to the lending section. Youngsters really feel at home in this library with its attractive decor of concrete and pinewood lit by large lamps (left). Below, young readers take book choices to the lending desk. Library has space for 10.000 books.

Photos Unesco-Dominique Roger

The new children's library at Clamart, near Paris, mantled in snow. Its design, based on a series of intersecting curves, makes maximum use of space. Popular with the youngest children is the Story Room where they listen to tales and follow them with the aid of picture books. Right library viewed from garden.

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Children find it great fun to walk around the Clamart library in their stockinged feet. They were first asked to take off their shoes because of the mud they tracked in when the area around was churned up by building operations. The rule has now been definitely adopted. Shoes are stored in compartments in the cloakroom (below). Children run no risk of chills; the heated floor warms their silent feet.

A PAINTING LENDING LIBRARY FOR JUNIOR

How would that look in my room? A young boy discovers some marvels of world art (left), reproductions of which are kept in a special collection at the library. Children can take away these framed pictures, just like library books, and keep them for up to two weeks. The collection is renewed regularly and ranges from abstract art to Renaissance paintings—a youngster may come across anything from a work by Max Ernest to a drawing by Leonardo da Vinci. Tasting art like this can inspire children with a real taste for art; aspiring artists can put their urges to work in rooms set aside for painting and modeling, and also get some help from the art teacher if they wish.

The library has over 300 foreign language books—English, Danish, Russian, Italian, German, Japanese and so on—which are equipped with tape-recorded texts in French. Here a boy pores over some fascinating illustrations in a Japanese book which he can also "read" on tape. So far more boys than girls have been making use of the library.

Photos Unesco-Dominique Roger

THE AMBER ROUTES OF ANTIQUITY

by Wladislaw Grzedzielski

Flowers and insects 20 million years old

Amber interests the scientist as well as the jeweller. In this translucid substance scientists have found perfectly preserved forms of life that existed on earth more than 20 million years ago. Caught in the sticky resin of giant pines, which eventually became amber, these remarkable fossils open a window on the animal life, vegetation and even the climate of a far distant past.

Photos National History Museum, Paris

Trading in amber began 3,000 years ago when the merchants of Phoenicia made long voyages in search of it, thus launching a commerce that was to spread throughout Europe. The great amber routes of the past which ran from the Baltic to the Mediterranean and the Black Sea, are shown on this map. Sea routes, probably those followed by the Phoenicians, are shown in white; dotted lines indicate where merchants travelled across country or by inland waterways.

ONE could hardly begin the story of amber without recalling a Greek myth which Ovid recounts in his *Metamorphoses*. No doubt most people have already heard it, but its charm is such that one may be forgiven for telling it again.

The adventure of Phaeton, who pursuaded his father Helios, the Sun God, to let him drive the Sun Chariot across the heavens, may serve as a warning to any young man who should ever aspire to take the controls of a space ship without a pilot's licence. The adventure ended disastrously since Phaeton, unaccustomed to driving the Sun Chariot, came too close to earth and nearly burnt up the universe. In his anger, Jupiter struck Phaeton with a thunderbolt and cast his body into the River Eridanus. Phaeton's sisters, the Heliades, were changed into poplar trees because they had yoked the horses to the Sun Chariot, and the tears they wept hardened into drops of amber which the river bore down to the sea.

What is really interesting about the legend is the idea that amber has a vegetable origin ("tree tears"). This was eventually confirmed at the end of the eighteenth century and in the nineteeth century by the research of such scientists as Lomonosov, Bock, Struve and others. Aristotle had already been on the right track in asserting that amber was a resin since it contained fossilized plants and insects which could only have penetrated the amber if it had originally been in a liquid state. Similar views were put forward during the Roman epoch by Pliny and Tacitus.

What was it that aroused the interest in amber displayed by Aristotle, Plato and the great Roman scholars? The answer lies in the Greek name for amber, "elektron", a word which provides the root for the universal term, common to all languages, "electricity". When rubbed with a piece of woollen cloth, amber attracts nearby vegetable bodies and it was this which linked elektron with physical phenomena observed subsequently. The Greeks and, no doubt even earlier, the peoples of the Near East and Egypt, regarded amber as a magical stone because of its electrostatic properties, its splendid colour and the fact that it was light and pleasant to the touch.

From remotest antiquity, therefore, it was used as an amulet, a talisman which ensured happiness, fecundity and protection against illness. In powdered form it was employed as a medicine; it was an ornament worn by kings and warriors; it was the favourite adornment of women. The main decorative element in the renowned crown of Tutankhamen in the Cairo Museum is a piece of sun-coloured Baltic amber surrounded with diamonds, emeralds and rubies.

Amber was of considerable value and the merchants of ancient Phoenicia, made long voyages in search of it, thus tracing out the first great amber routes.

Various varieties of amber exist in every continent but the widest range is to be found in the Baltic Sea region where, according to the Greek legend, the Eridanus flowed into the sea. The amber of the Baltic coast is distinguished by its superb colouring in various shades of yellowish-brown, so that from earliest times it was known as "Northern Gold"—a name further justified by the fact that it was worth its weight in gold.

Before the Ice Age, in the tertiary period from the Upper Eocene to the Lower Oligocene—between 45 and 34 million years ago—the regions now occupied by Scandinavia, the Baltic Sea and the northern parts of the U.S.S.R. Poland and Germany were covered with vast forests. These "amber forests" consisted mostly of resinous trees and especially pines (*Pinus succinifer*) which must have had great powers of secretion since blocks of amber weighing several kilogrammes are still found today.

The largest quantities of amber, whether brought up from the sea bed, washed ashore by storms or extracted from the earth, are to be found in the Sambia peninsula in the eastern part of the Gulf of Gdansk, which was known to the Romans and the Arabs.

The word amber was borrowed from the Arabs and the Roman "ambar" is the origin of the name used in all the Romance and Anglo-Saxon languages. In Germany it was baptized "Bernstein", a derivative of "Brennenstein"—the burning stone. This, of course, was because of the inflammability of amber, the splendid flame with which it burns and the perfume which it exudes.

I have already mentioned the sea route which was probably the first followed by the Phoenicians in the search for amber. It passed through the Mediterranean and led along the Atlantic coasts to the Jutland peninsula which was the base for trade with the Baltic region. Another great European amber route ran from Massilia, now Marseilles, which was an important trade centre, followed the Rhone

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WLADYSLAW GRZEDZIELSKI *is a Polish journalist and is secretary-general of the Polish National Commission for Unesco.*

The North Pole in a tomb of resin

and the Rhine and then proceeded overland to the shores of the Baltic.

In the final volume of his *Historia Naturalis*, the Roman historian Pliny gives an account of one of the Roman expeditions to the Baltic Sea region which brought back vast quantities of the precious substance, including blocks of amber weighing as much as thirteen pounds! Among other things, this amber was used to sand the arena of the circus where the games were held in Nero's time.

The most important trade route followed by the Roman and Arab amber-seekers passed through what is today Poland, and numerous traces have been found in the course of excavations which have uncovered coins and other objects of Roman or Arab origin together with "amber hoards" which were in fact the caches where the wholesale merchants or their agents stored the amber while awaiting the arrival of the buyers.

At that time there were no roads in Central Europe, and dense forests, mud, snow and wild beasts made all travel difficult. As a result, people relied primarily on waterways and the navigable network between the Vistula, the Dniester and the Dnieper, like a great fan linking the Baltic and the Black Sea, was ideally suited to the purpose. This route comprised four "spokes": the first began on the Gulf of Danzig and followed the Vistula, the Bug, the Pripet, the Dnieper and the Don, crossing the Kuban and the Tigris to end up on the Persian Gulf whence the amber was sent on to the markets of the Near East and especially those of Persia.

The second possibility was to follow the Vistula, the San and the Dniester to the Black Sea where the amber found ready buyers among merchants from Egypt, Greece and Southern Italy.

The third path was along the Vistula to the Warta and then by minor rivers to the Odra, ending at a point on the site of what is now Wroclaw which, to judge from the many "amber hoards" since found there, must have been one of the most important centres of the amber trade. From Wroclaw, the amber was carried overland across Moravia to Northern Italy. On this route lay the ancient Roman colony, of Vindobona, an important trading centre, which became the city of Vienna.

The most north-easterly route linked the Baltic Sea and Byzantium and ran along the Neva and the Dnieper. Amber was not the only product imported from North-East Europe, which also supplied livestock, furs and feathers, the largest importing centres being in the areas where Venice and Trieste now stand.

THE Roman and Arab traders mainly bartered amber for objects in iron and bronze, ornamental weapons and fine cloth. From the sixth century onwards they paid in gold coins as proved by the vast quantities of coin from whole Mediterranean basin which have been found during excavations along the "amber routes" described above.

The town of Kalisz in North East Poland boasts of a 2,000-year-old tradition: it arose on the site of the ancient colony dating from the days of the Roman merchants' expeditions, a colony known as Calisia which, like Wroclaw, was undoubtedly one of the centres of the amber trade.

The great popularity of amber in ancient times came to an end with the fall of the Roman Empire. The last mention of amber from the period immediately following the break up of the empire is to be found in a letter from Cassiodorus, Chancellor of Theodoric the Great, conveying his thanks to the Baltic Estes tribe for a gift of amber from the Sambia peninsula. "We greet you", wrote Cassiodorus, "and we inform you that we have received with pleasure your gifts of splendid amber. The sea bestows on you these stones which gleam with so marvellous a light and yet your envoy tells us you are utterly unaware of their origin even though you were the first to receive this gift from the sea".

In the Middle Ages, as in modern times, amber was primarily used as an ornament and a jewel. European museums often contain superb carvings, decorated cups or small boxes which are masterpieces of the jeweller's art, since amber lends itself admirably to carving and decoration, a fact of which artists have taken the utmost advantage. Nevertheless, people continued to ascribe to it magical and curative properties. When, for example, Prince Albrecht sent his wishes for a speedy return to health to Luther, in the 16th century, his message was accompanied by a magnificent piece of amber.

NOT only the Arabs but, until the begining of the twentieth century, almost all the peoples of Europe used amber for making pipe-stems and cigarette-holders. This may well have been the outcome of a traditional belief which endowed it with what we would now term bactericidal or disinfectant properties.

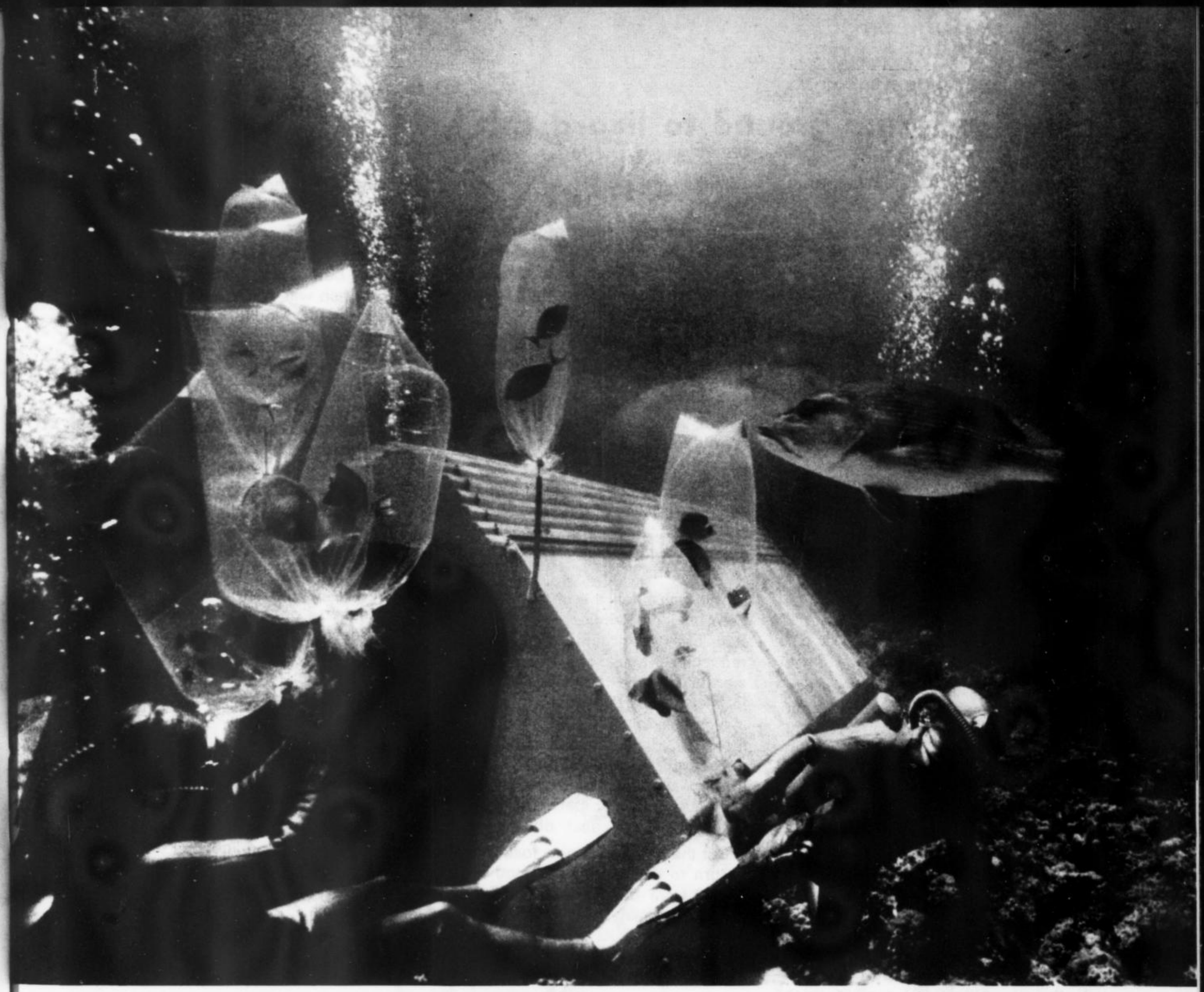
Amber served yet another purpose in the sumptuous palace of Catherine of Russia at Tsarkoie Selo near Saint-Petersburg (today Pushkino near Leningrad). One of the rooms was entirely lined with amber and all the furniture and objects which decorated this room were encrusted with it. This unique masterpiece was destroyed during the Second World War.

In the second half of the nineteeth century and the beginning of the twentieth new uses were found for amber; in particular it was found to be a valuable source of knowledge concerning the plant and insect life of various geological epochs. The resin of the "amber trees" not only enclosed plants but also innumerable arthropods, insects and even lizards. Such fossils helped scientists to identify 190 species of plants and some 1,200 species of arthropods and insects.

The knowledge so acquired has aided research in other fields; the fact that almost all types of "amber forests" are similar to plant species in East Asia and North America today led to significant discoveries concerning the climate of that epoch and confirmed the theory that there had been a shifting of the North Pole and changes in our planet's climatic zones. Feathers found in pieces of amber likewise provide ornithologists with valuable leads.

While out walking during a recent vacation near Danzig I found a scrap of transparent honey-coloured amber in the sand. Holding it up to the sun, I observed a host of small dark spots inside—a microcosm of an epoch as far distant from ours in time as the celestial bodies of galaxies discovered in the twentieth century are from us in space.

The wonder of amber! And the astonishing story behind the routes which led to it! They are routes which seem made for communication and contact between men rather than for war and pillaging. Amber fascinated scholars and fair women, merchants and poets, and the route which led to it has become one of the great arteries of civilization.



Undersea aquarium. Members of a French oceanographic expedition in the Red Sea return to their sea-bed base with collections of fish held captive in plastic bags.

© Les Requins Associés, Paris

A new Mediterranean fishing problem

THE TRANSMIGRATION OF SHOALS

by Daniel Behrman

TWO gigantic—and involuntary—human experiments are affecting the biological environment of the eastern Mediterranean Sea.

The first in point of time, for it is nearly one hundred years old, was the digging of the Suez Canal which opened an artificial waterway for marine life as well as shipping between the Red Sea and the Mediterranean.

The second, much newer, is the sudden cut-off of a flow of silt loaded with nutritive substances into the eastern Mediterranean following the construction of the new Aswan High Dam which has already reduced and will

CONT'D ON NEXT PAGE

Goat-fish losing ground to lizard fish

shortly arrest the seasonal floods of the Nile.

Oceanographic research into the effects of these man-made changes in the sea may become a subsidiary aspect of a co-operative study of the South Mediterranean and the Levant. The study, to be focussed on the Atlantic Current entering the Mediterranean at the Straits of Gibraltar, was recommended by a recent Unesco-sponsored inter-regional meeting of scientific experts from thirteen countries at Split, Yugoslavia.

The problem of the Nile flood directly involves sardine fisheries in the Levant. Traditionally, fishermen all along the eastern coast of the Mediterranean enjoy a bonanza every year as sardines teem in the muddy waters of the flood, first off the Nile delta in September, and then as late as the following spring off Lebanon.

These waters form a grey surface layer which can be seen from the air as far north as the coast of Lebanon. Plant life flourishes on this sudden dose of fertilizing nitrates and phosphates which produce green blooms of phytoplankton. Quickly, the next link in the food chain of the sea, zooplankton, appears to provide the minute animal life upon which the sardines feed.

IT is not only through this massive transport of minerals that the Nile flood creates more favourable conditions for marine life. The eastern Mediterranean is highly saline—39 parts per thousand, compared to an average of 35 through the oceans—but this solution is considerably diluted by the autumn onrush of the waters of the Nile. A drop in salinity can favour certain groups of marine organisms.

Now, the Nile flood will vanish. Although insignificant economically compared to the benefits of the Aswan High Dam, the consequent loss to fisheries will have to be studied in all its side effects.

Research on this and other effects of the damming of the Nile, the experts felt, should start at once when the process is only beginning. This will provide a base point against which future findings can be compared.

Dr. El Sayed Mohamed Hassan, director of the Suez Branch of the Institute of Oceanography and Fisheries of the United Arab Republic, said that the UAR is already making surveys to determine these effects and will continue them until the dam is completed.

Unfortunately, such surveys do not exist in the case of the other man-made change in the ecology of the Mediterranean, the opening of the Suez Canal.

Most of the year—about eight months—the current in the Suez Canal flows from the Red Sea to the Mediterranean. With it come both fish and forms af plankton, anything from one-celled plant life to larvae of fish and invertebrates, that must depend upon currents for transport

Once they have passed through the canal, a process of colonization begins. Not all forms of marine life survive the change by any means, but some appear to thrive on it.

This has been the case of the goat-fish, an Indo-Pacific species from the Red Sea. Up until the late 1940s, red mullet was the main catch of fishermen along the Levant coast. Then, in the 1950s, the goat-fish appeared in commercial quantities and, according to Dr. Heinz Steinitz of the zoology department of the Hebrew University of Jerusalem, it has replaced the red mullet as a major catch as far north as the Turkish coast off Iskanderun.

But the goatfish is now losing ground in turn to the lizard fish, another newcomer from the Red Sea. This is a voracious animal that appears to eat anything, even its own young, and it is a fearsome competitor. While fishermen's hauls do not diminish in weight as a result, the lizard fish fetches a lower market price than its victims did in the past.

Dr. Steinitz did not foresee any ecological changes in the Mediterranean as drastic, for example, as the result of the introduction of the rabbit into Australia, but he commented, "as soon as you transplant an animal or a plant into new surroundings, you can expect anything."

AT the Split meeting, Prof. Jean-Marie Pérès, who heads the Endoume Oceanographic Centre in Marseilles, remarked that the first large-scale appearance of Red Sea species occured in the Mediterranean between 1940 and 1945.

"But certain countries had other things to do at the time", he said wryly, "and this phenomenon could not be properly observed. At present, nothing enables us to say whether the change will be good or bad."

One question immediately comes to mind: why did the change occur so long after the opening of the Suez Canal?

It does seem certain that marine life was moving across the isthmus of Suez long before the 1940s. The first Red Sea fish was found about eighty years ago in the Mediterranean by a zoologist on the Suez Canal staff.

But there were no reports of Red Sea fish in the commercial quantities now being found. The explanation seems to lie in the Bitter Lakes through which the canal runs. When the sea receded in past geological times from the isthmus of Suez, it left behind great beds of salt and the Bitter Lakes. These salt beds raised the salinity of the Bitter Lakes to a point so high that it prevented the passage of marine life in any significant amounts when the canal was opened. But then a gradual process of flushing began and the salinity of the Bitter Lakes dwindled until it reached a level where it no longer constituted an almost impenetrable barrier against the migration of Red Sea organisms.

WHEN these Red Sea fish, invertebrates and plants compete with indigenous species for survival in the eastern Mediterranean, they have several factors on their side.

The salt content at the northern end of the Red Sea is 41 parts per thousand, while that of the southeastern Mediterranean is only 39. Ability to adapt to high salinity may help explain why Red Sea life has been able to pass more easily through the Bitter Lakes than Mediterranean species. But once these animals are in the less salty Mediterranean, they find more favourable conditions under which they flourish.

At the same time, the Levant is an outer fringe for West Mediterranean and Atlantic species penetrating the Straits of Gibraltar. They are dwarfed here in comparison to their size further westward and less fitted to wage a struggle for survival.

At present, thirty species of Red Sea fish are believed to have migrated into the eastern Mediterranean. Scientists at the Split meeting did not view this as any sudden increase or cause for alarm.

But, they agreed, research must be carried out now if the process is to be followed closely from its inception, with the movement of individual specimens or larvae, to its culmination with the appearance of an unfamiliar haul in the nets of commercial fishermen.

The curved lead plate which this printer is carrying to a rotary press in Lagos (Nigeria) will print two pages of a local newspaper. Today the leading newspapers in tropical Africa are printed in English or in French. Standardized alphabets are now planned for some of the most important African languages spoken in vast areas, from Senegal to the Cameroons. They will then be able to play a major role in education and the circulation of news and information. Literacy textbooks, grammars, dictionaries and reading materials will be prepared and published with the co-operation of the Unesco Regional Centre in Accra.

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Ancient scripts from the heart of Africa

by Dimitri A. Olderogge

IT would be difficult to overestimate the importance of writing in human history; writing made it possible for each generation to pass on to posterity the knowledge it had accumulated.

In his *Ancient Society*, the American ethnographer Lewis H. Morgan made the appearance of writing the starting point of civilization. Karl Marx agreed with Morgan on the significance of writing in the history of society and Marx's colleague, Frederick Engels, said in his book, *The Origin of the Family, Private Property and the State*, that civilization began with the invention of writing and its utilization for literary purposes.

The hieroglyphic writing evolved by the Egyptians in the fourth millenium B.C. served as the basis from which the alphabets of the Mediterranean and India were later developed. The hieroglyphic writing of the peoples of the Far East—China, Korea and Japan—appears to have developed independently of the Mediterranean cultures. The same may be said of the writing of the American people, the Mayas in particular.

One of the most ancient systems of writing, the hieroglyphic script of Ancient Egypt was created in Africa (in the Nile Valley), but it did not influence the development of writing among other peoples of the African continent; the one exception was the writing of the ancient Nubian kingdom of Meroe (600 B.C. to 400 A.D.) which was obviously the result of Egyptian influence.

Because of this it is usually assumed that the peoples of the Sudan and tropical Africa never developed scripts of their own; it is true that the Vai tribe in Liberia invented a script in the early nineteenth century, and so did the Bamum, of the Cameroons in the twentieth century, but these were considered exceptions. It was also affirmed as an indisputable fact that both scripts were invented under the influence of either European or Arabic scripts. But is this true? Is it conceivable that the African peoples, with their original self-created culture, never advanced to the stage of inventing some system of writing?

When Portuguese navigators first reached the west coast

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'Nlo tre' = to carve symbols on a calabash

of Africa, there were states in existence along the whole length of the Upper Guinea coastline. The accounts of European travellers—mainly Portuguese, Dutch, and English, but also German and French—give descriptions of them. In the sixteenth and seventeenth centuries trade was so highly developed along the seaboard later known as the Gold Coast, that Portuguese ships carried slaves from Benin for sale to African merchants, instead of carrying them to Europe. The African merchants used the slaves as porters to take goods into the interior and bring back gold and ivory.

The first European caravels were met by large fleets of vessels sent out by local rulers, some of them capable of carrying a hundred men. This fact alone shows that the Portuguese navigators found the western seaboard of Africa inhabited by peoples who had reached a high level of culture. Any doubts there may be on this score are dispelled immediately one calls to mind the ancient bronze reliefs and sculptures in the round produced by the artists of the Benin and Yoruba peoples.

These bronze castings have been preserved. They include portraits of a king and his heir, an army commander and many other high-ranking persons—all indicative of an elaborate court ceremonial. Each officer or courtier wears some mark of rank—headdresses, shoulder sashes, masks worn hanging from the belt, which are the equivalent of modern badges and insignia, and special types of swords called *ada* or *ebere*.

Some reliefs show a nobleman of high rank setting out on a journey accompanied by a numerous suite. The nobleman is mounted on a horse with young men supporting him on either side; armour-bearers carry his sword and shield and his servants hold their shields high above their heads to protect him from the sun. The nobleman is taller than the servants around him; the artist has done his best to stress social inequality in the same way as those who carved the reliefs of ancient Egypt.

It is easy to picture Benin from the descriptions of travellers of that time. Houses in the town were built close to each other in straight rows as in Dutch towns. The king's palace, wrote a seventeenth century traveller, was as big as the town of Haarlem. The streets were wide and straight, as wide as the Herengracht or the Keyzersgracht in Amsterdam; side streets almost as wide led away to left and right.

WE know this from scraps of evidence that have chanced to survive, and fortunately there are enough to show the high level of culture in ancient Benin. We now know that the Benin culture was only one branch of the ancient and highly developed culture of Yoruba. Since little of the Yoruba culture has been preserved we might have regarded the tales and legends of the Yoruba about their past as pure invention had it not been for the bronze and terracotta sculptures—real gems of African plastic art—that have been discovered recently. We have little information on the states that lay to the west of Yoruba—only the tales of travellers and merchants who visited the Gulf of Guinea between the sixteenth and nineteenth centuries. But these are sufficient to show that all along the Guinea Coast there were states with developed cultures and that to the west, north and east there were peoples with considerable lower levels of culture.

All this gives us much to ponder on. One wonders why, in the nineteenth and twentieth centuries, peoples like the Vai, Ekowi, Bamum and Toma who lived on the periphery of the West African states should have had their own systems of writing, whereas nothing has been found to suggest that any system of writing ever existed in the coastal kingdoms. Why did the Vai script appear among a people at a lower level of culture than that of Yoruba or Dahomey? How did the Nsibidi inscriptions come to be made by tribes living in the dense jungles around the Cross River in the Cameroons?

One would naturally expect the peoples of Dahomey, Yoruba and Benin, and other similar kingdoms to have had their own systems of writing at some time. This seems more than likely since the state must have needed records of tributes received and taxes due, and reports on the state of the army; it also had to issue orders and instructions. Yet the question has never been investigated.

AMONG the scripts of the Guinea Coast those of the Vai and Bamun are the best known. The Vai script was discovered in 1849 by S.W. Kölle who came away with the impression that all adult men in Bandakoro could, to some extent, read and write, and that in other villages there were always a few people who could read the native script. The American Africanist, Oric Bates, noted in 1834 (thus even earlier than Kölle) "the Vai have written volumes."

The rapid spread of writing shows that the appropriate conditions for its invention must have existed long before. Syllabic systems of writing derive from pictographic symbols, and the "invention" of the Vai script by Momolu Doalu Bukele and some helpers consisted of selecting suitable symbols and arranging them according to a precisely defined system. Momolu Massakwa, the Liberian consul in Britain, has told how the Vai transmitted news of a sudden attack by their enemies, of the outcome of battles and other events, by means of pictograms on strips of bark. To say that the enemy had been defeated and had fled they drew the figure of a man running with his hands on his head and put a dot beside it to indicate the plural. It was symbols of this kind that were used as a basis for the syllabic alphabet.

The history of the Vai script is quite clear—the symbols gradually acquired a phonetic character and represented the sounds of the syllables. Professor August Klingenheben, an eminent linguist, discovered that the Vai script depicts very exactly the phonetic structure of the language (there are symbols which differentiate between syllables containing two types of B and two of D, symbols for nasalized vowels and for labio-velar sounds). He concluded that it could only have been invented by native speakers of the language.

Influenced by the Vai writing, neighbouring tribes rapidly assimilated its principles and invented their own systems. We now know that similar systems of writing exist among the Mende, Bassa, Gerze (Kpelle) and Toma (Loma).

The history of the Bamum script is now well known. Njoya, the chief of the Bamum, evolved this system from symbols that had been in use before him and which had long been known in the savannahs of the Cameroons. In his lifetime, Njoya four times reformed the Bamum script to give it a more systematic form.

Both the Vai and Bamum scripts, therefore, were created by turning ancient systems of symbols into a standardized system. The older symbols have not been preserved because they were inscribed on perishable materials—wood and bark—which did not survive long in the damp tropical climate of West Africa.

The Nsibidi symbols, widely used among the Ibo people (a tribe four million strong) in southern Nigeria, only became known in Europe in 1904. The Nsibidi symbols are not a real system of writing because one symbol may be used for several different meanings and the same idea can be expressed by several different symbols. The number of symbols was unlimited and the way of drawing them was not systematized.

The Leningrad Museum of Anthropology and Ethnography (U.S.S.R. Academy of Sciences) possesses a number of calabashes from the Cameroons, many of which are covered with Nsibidi symbols based on pictograms. These inscriptions are usually "records" of proverbs, "the sayings of the old men". It is no accident that in the Ewe language, for instance, the verb *nlo* means "to carve" (drawings) and also "to write"; *nlo tre* means "to carve drawings on a calabash" and *nlo leta* means "to write a letter" (from the word "letter").

It seems that records of this type must have existed throughout the Guinea Coast but they were never studied and have now disappeared since they were written on perishable materials like wood and calabashes.

The systems of recording numbers are better known. Trade in gold has been conducted on the Gold Coast and the Ivory Coast for centuries and gold dust was sent by caravan routes to the trading centres of Western Sudan—Djenne, Bamako, Mopli, Timbuktu, and other towns. The gold trade continued from the twelfth century until 1591 when the Songhai kingdom was crushed by Moroccan troops. Weights were needed to weigh the gold dust, and some made of bronze have been preserved. They are covered with different symbols—circles, spirals, volutes, incisions, etc. Studies of these inscriptions show that they are conventional signs for weights.

THERE is no doubt that the payment of tribute had to be recorded, and that some system of writing was needed apart from figures. Unfortunately nobody has taken up this problem, but I believe that something like a system of writing must have existed in Upper Guinea for a long time. I base my theory on the following facts.

Among the regalia of the kings of Dahomey was a ceremonial axe with a decorated biade. Ceremonial axes of this kind could be "read", since each of them had its own particular significance. King Takdonu or Dakodonu (1625-1650) had an axe of very strange design. According to A. Le Herissé, a French scholar who studied the history of Dahomey, the blade of the axe could be read in this way: above there was a symbol depicting flint—*da*, below a depiction of the earth—*ko*, with a hole in it—*donu;* together these make the name Dakodonu.

Le Herissé's Dahomey friends presented him with an axe depicting his name. On the blade there was a local tree—*hun* with its leaves—*ama* bound by a rope—*kan* and with spaces between the leaves—*biyo;* this was read as *nma-kambiyo* a word meaning "it doesn't matter, it is not necessary". This was also the name given to Le Herissé by his Dahomey friends because he repeated the word so often.

These examples show that the people of Dahomey long ago developed the principles of hieroglyphic writing and it has not been preserved simply because the materials they used were not long lasting.

We also find less developed systems of writing on the walls of Dahomey's palaces; they strongly resemble the hieroglyphs of ancient Egypt, for instance those at Narmer and other cities, where the early form of the cartouche contained both pictograms and hieroglyphs. The Egyptian Pharaoh was drawn as a hawk with a hoe in his talons destroying city walls, or as a bull trampling a man underfoot or tearing down a wall with his horns.

Of similar character are the reliefs on the Dahomey palace walls that show the kings of Dahomey as elephants or mighty birds tearing their enemies to pieces. In both ancient Egypt and in Dahomey we find the earliest stages of the development of a system of writing.

From "L'Ecriture des Bamum", IFAN 1950

"King Njoya teaches the first characters of his writing to the nobles" says the inscription in Bamum at the top of this drawing. Njoya, King of the Bamum (Cameroons) invented a pictographic script at the end of the 19th century, and later transformed it into a syllabic and phonetic alphabet (see the Unesco Courier, Nov. 1950). There is an anachronism in the drawing. At the time their alphabet was devised, the Bamum had not yet adopted the Islamic dress in which the artist, Ibrahim Njoya, has depicted them.

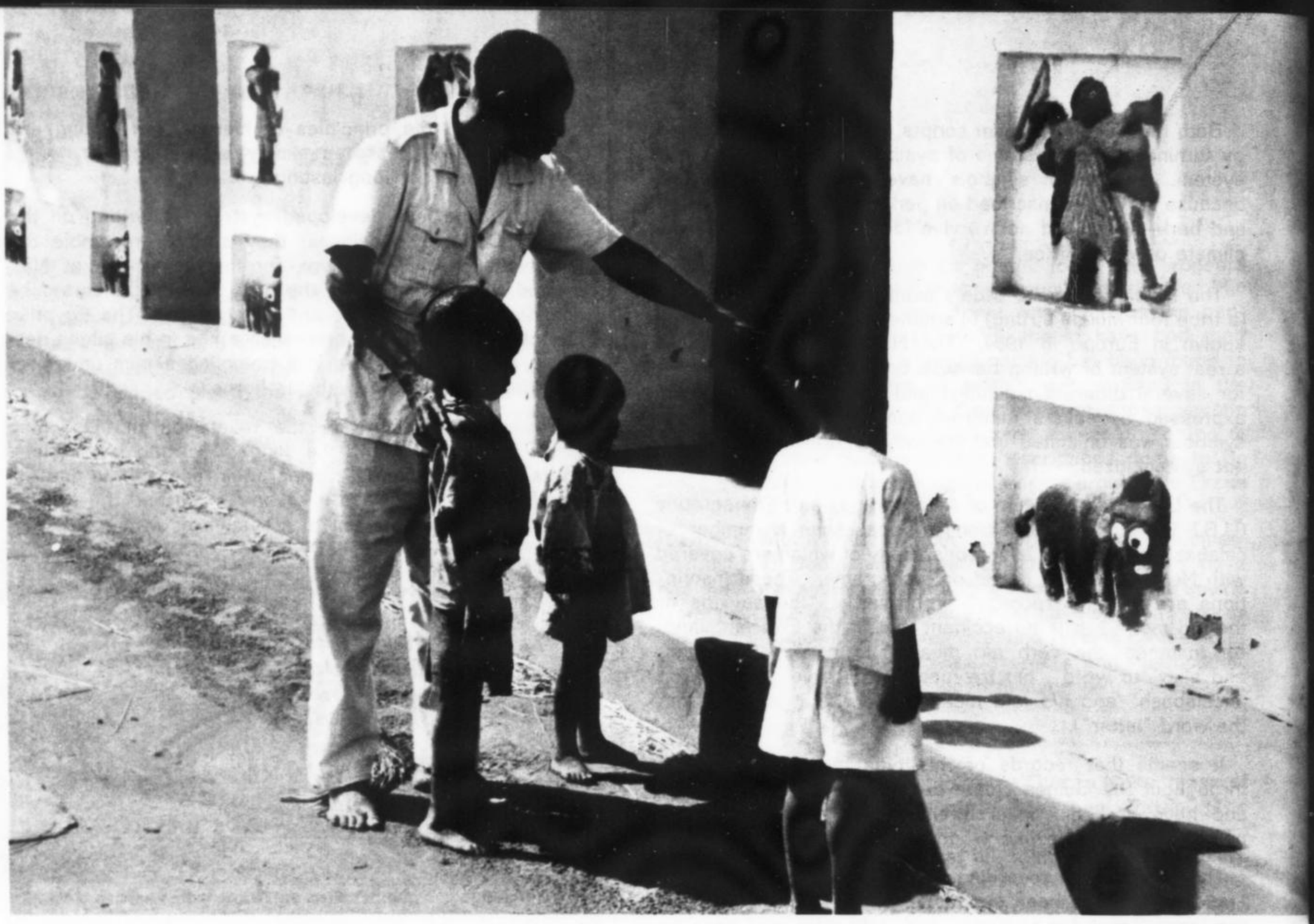
The arrival of Portuguese merchants on the Guinea Coast and the systematic hunt for slaves that followed interrupted the independent development of the peoples of that area and doomed them to suffer all the horrors of the slave trade which prevented any further development of their native culture.

Traces of earlier systems of writing are also to be found among peoples inhabiting the southern part of the continent. An Italian missionary, Gazazzi da Monecuccolo, said in his *Historical Description of the Three Kingdoms of Congo, Matamba and Angola* (Bologna, 1687) that hieroglyphic writing was widely used in Matamba.

The Portuguese historian Barroch tells of an inscription in an unknown language which he saw over the doorway at the entrance to one of the stone buildings in the land of Monomotapa. However, this statement is not universally accepted; some scholars believe he may possibly have seen a carved ornament such as was frequently used to decorate the walls of stone buildings.

It is difficult today to say whether a system of writing actually existed in the sixteenth century on the territory now

CONT'D ON NEXT PAGE



Unesco-P.A. Pittet

Scripts of the Tuaregs, Swahili and Nubians

known as Rhodesia. In the National Museum at Bulawayo there is a manuscript report written by Blake Thomson, one of the explorers of this area. This quotes a statement by one of the local inhabitants, a man named Lino, who declared that the Nyungwe people who lived on the banks of the Zambesi once possessed manuscripts written on skins. They were kept in the temple of Murenga and were copied from time to time as the leather perished. The copyists tried to imitate the symbols exactly although they did not know their meaning. It is a pity that Blake Thomson's report and the copies of the symbols preserved in the same museum have not been published

A hieroglyphic inscription discovered on the cliffs at Cholemba near Tete (Mozambique) on the middle reaches of the Zambesi was published in 1896. This inscription did not seem to attract much attention, although to this day it remains the only evidence of the existence of an ancient system of writing in South Africa. It can scarcely be a hoax since it was discovered at the end of the last century when nobody was interested in the history of the African peoples. However, it would be a mistake to draw any definite conclusions until further discoveries have been made.

We may sure that many of the peoples of the Guinea Coast, people who were free of all outside influences until the fifteenth century, had the rudiments of systems of writing and even developed systems.

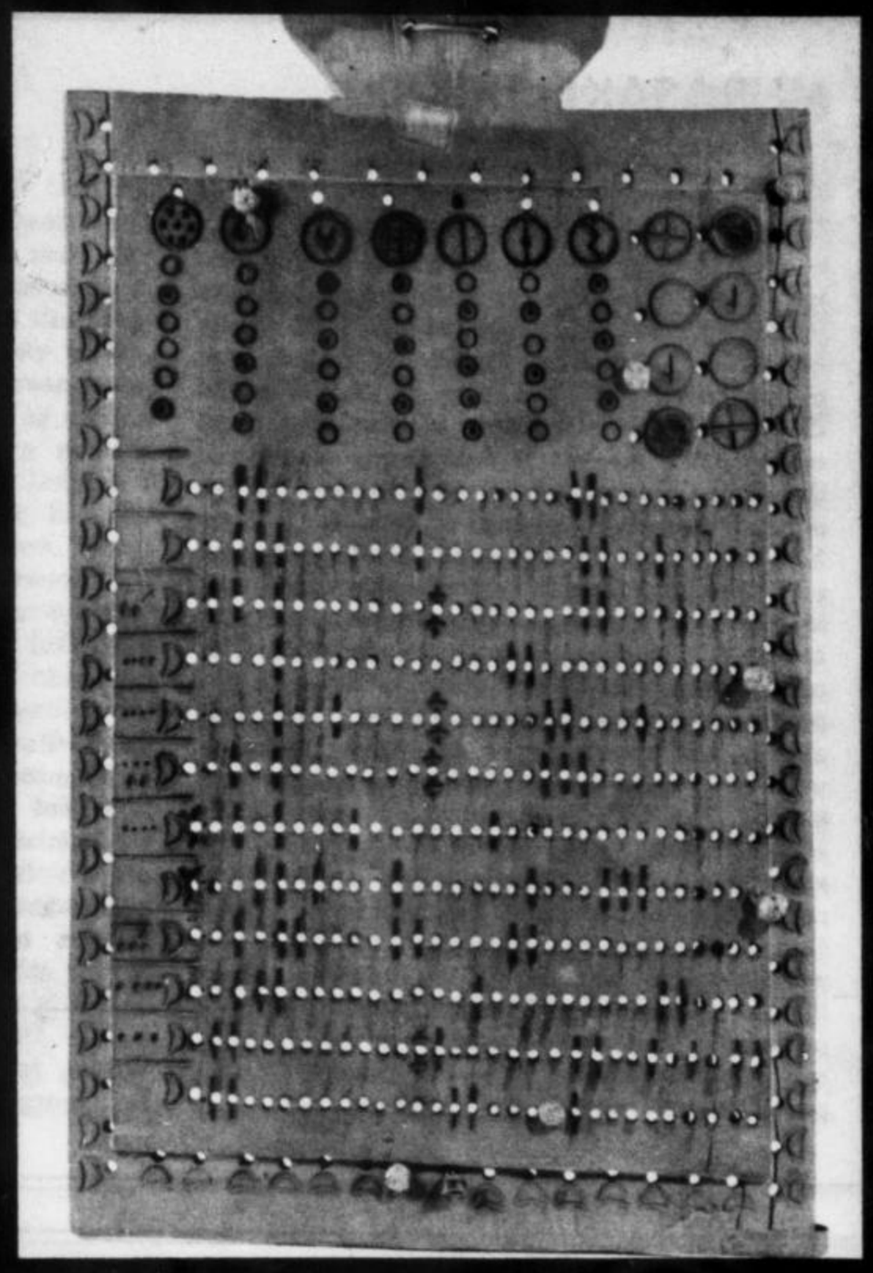
The peoples of the Sudan and East Africa came under the influence of Arab culture and Islam and created their own scripts on the basis of Arabic. Just as adaptations of the Arabic alphabet were made to suit the needs of the Turkish and Persian languages, so systems of writing in Arabic characters were devised by many African peoples. Among the languages so written we may mention Swahili with its rich literature and those of the Western Sudan—Hausa, Fulbe, Kanuri, Manding and others. Nor must we forget the writing of Ethiopia whose original script was devised early in the Christian era from the South Arabian Sabaean script.

In Christian Nubia, the ancient Nubian system of writing was devised in the tenth century under the influence of the Coptic script. Nobody even suspected the existence of this Nubian script until 1906, when among Arabic and Coptic manuscripts received by the Berlin Museum from Egypt some in an unknown script were discovered. Studies showed that they were written in the ancient Nubian language which makes them the oldest written records of African languages proper.

Today, as in past centuries, the Tuaregs of the Sahara use a special script known as *tifinag* which is a development of the ancient Libyan and Punic scripts used in North Africa at the time of Carthage, in the second century B.C.

Now that most of the African peoples have freed themselves from colonial dependence, the problem of scripts for the African languages has become more urgent. All the newly-independent states have naturally chosen as their primary task the achievement of economic independence. This requires them to develop their own industry as rapidly as possible, to build factories, construct ports with

Axes with languages to grind



The people of Dahomey developed a form of hieroglyphic writing over three centuries ago. They used it to give specific meanings to the designs of the ceremonial axes known as "recades". Above, a decorated axe blade bearing the emblem of King Glele, which signifies "I am the lion cub which spreads terror from the moment it has teeth." Left, a Dahomean father explains to his children the meaning of one of the reliefs sculpted a century ago on the palace of one of Dahomey's monarch's, King Ghezo of Abomey. These allegorical figures, which recount the king's exploits, are actually a rudimentary form of writing. Right, an ancient Dahomean calendar. Three calendars are combined on this board into which marks have been burned and holes bored. At the top, from left to right, are seven rows of circles: large ones represent the days of the week; small ones indicate the propitious and the unfavourable "moments" of the day and night. A local calendar (top right) is based on the days for holding markets. The twelve rows of 30 holes each which cover most of the board compose a yearly calendar based on lunar periods. Holes marked with a sign announce tornadoes or rain. Dots tell when to plough and sow.

Photos © Musée de l'Homme, Paris

modern equipment, create highway and railway networks, and to solve town-planning problems, all of which requires skilled personnel—engineers, technicians and an army of proficient workers. Such skilled personnel can only be trained if the people are literate.

There is no doubt that English and French, and perhaps some other European languages, will remain the basic languages for secondary and higher education in many countries of tropical Africa; primary education, however, must be given in the local languages. Among the young people of the African countries there is a great desire to learn; all sections of the population are eager for knowledge.

I have seen how Africans are trying to devise alphabets for their peoples. Different people have different ideas about how the problem is to be solved; some propose to devise symbols like the Vai or Bamum of which we have already spoken, and to make up an alphabet from them; others suggest using the Arabic alphabet as a base; the third group, and its members form the majority, want to take the Latin alphabet and adapt it to the phonetic system of their own languages. In this field, too, there are many difficulties.

The most widespread and best-established systems of writing now in existence are those of the Swahili and Hausa languages based on the Latin alphabet. The two scripts are similar since they make use of the English pronunciation of Latin letters and their combinations, although there are some slight differences. Swahili, for instance, uses the English combinations CH and SH while Hausa uses C instead of CH, but uses SH like Swahili. The vowels are not given their English value but follow "continental pronunciation," as the British say.

In the former French colonies, where teaching in the local languages in state schools was forbidden, the work of creating scripts has to begin from scratch. A number of African languages have spread from countries where the official language is English to countries where it is French. The Hausa language, for instance, is spoken in "English" Nigeria, in Niger, Dahomey, Tchad, etc., where the French language has been accepted. The question then arises should the traditional English system of spelling be retained, or should the French system be used, for instance, CH instead of the English SH. Vowels create an even more difficult problem.

In short, a number of specific problems exist. If they are solved within the boundaries of a single state, many people will remain divided—the Fulbe, Hausa, Mosi and many others are kept apart by the political boundaries of English-speaking and French-speaking states. Unsolved problems will have to be dealt with at special conferences attended by linguists and representatives of the African governments. For this purpose a number of conferences have been held in recent years in the biggest university towns of West Africa—in Ibadan and Accra—at which the problems were discussed.

The most recent conference on linguistics was held at Bamako under the auspices of Unesco. It dealt with the alphabets used for the chief languages of the Western Sudan—Hausa, Manding, Kanuri Fulani, Tamasheq and Songhai. The aim of the conference was to bring concord into the writing of these languages through the production of a standardized alphabet.

In this short article we cannot deal with all the problems that affect the African languages. The problems are many, but we have to make the first advances by establishing standard systems of writing for the most important languages of the African continent.

GREAT M
GREAT E

MURASAKI SHIKIBU

The world's oldest novel, The Tale of Genji, **a Japanese work of the tenth century was written by a woman, Murasaki Shikibu. Her exact date of birth is unknown, but she is thought to have died about 1016. Lady Murasaki, as she is sometimes called, was the widow of a dignitary at the Imperial Court of Japan. She was a woman of great culture, like so many nobly-born women of the Heian Period, which was marked by an unprecedented flowering of art and literature in Japan. In the tenth century a new and simplified form of writing called Kana was invented in Japan. Women in particular adopted it in preference to the old-style Chinese characters. Kana made a vigorous impact on Japanese literature; stories, narratives, diaries and novels began to appear. Women were revealed as outstanding novelists and poets.** The Tale of Genji **was to make Lady Murasaki the most famous of them all. Her work is a long, 1,000-page novel which, while recounting the amorous adventures of Prince Genji, describes the exquisite refinement and psychological complexity of Japanese court life at that time. Murasaki Shikibu was a perceptive and sensitive observer of life who might well be said to have "invented" the psychological novel six centuries before it made its appearance in the West. Its influence on Japanese literature was considerable not only on the novel, but equally so on Noh drama and the Kabuki theatre. This classic of Japanese literature is now part of the universal cultural heritage. The most famous translation into English is that by Arthur Whaley, first published in the 1930s, and it is this version that has been accepted in the Unesco Collection of Representative Works, for which it has now been reprinted by George Allen and Unwin, London.**

FRANZ HALS

The name Frans Hals is one of the most renowned in Dutch painting. Hals (sometimes called "Hals the Elder"—five of his sons became reputed artists) was born in 1580. The dating of his first authentic work, a portrait, as 1613 shows that he made a late start on his career, and it is often said that he had hitherto led a dissolute and improvident life. Nevertheless he quickly made up for lost time and established his reputation with the now famous "Banquet of the Archers of Saint George", painted in 1616. This splendid group, in which the influence of Rubens is clearly apparent, revealed Hals as master of portraiture and of colour harmonies. Hals continued to paint the large portrait groups that were now in fashion and replacing allegorical and religious paintings in homes and public buildings. Most of his later works were individual portraits painted in sombre tones dominated by black, grey and silvery shadows. Hals was gifted with deep psychological insight. His portraits reveal a searching analysis of character whether the model is a great man such as Descartes or a simple gypsy girl, whether a fisherman or a carefree youth. Hals died in 1660—three years before Rembrandt. Throughout his long career he continued to develop his painting techniques, using ever larger, bolder and more rapid brush strokes, and overriding the confines of the sketches on his canvas. Not without justification is he now called a precursor of Impressionism.

MIGUEL DE CERVANTES

The name of Miguel de Cervantes—inseparable from that of his hero Don Quixote—is one that dominates world literature. The life of Cervantes resembles a picaresque novel. The son of a poor surgeon, he was born in Alcala de Hénarès in 1547. From his earliest years he displayed a passion for books. At 17 he enlisted as a mercenary in the service of the Colonna (an important Roman family), a life which took him across all of Italy. He lost the use of his left hand at the battle of Lepanto in 1571. The galley bearing him back to Spain was seized by the Turks. He was sent to Algiers as a prisoner where he suffered hard privations and was finally ransomed. Cervantes was in Madrid in 1580 trying to live by his pen. He wrote plays, led a poverty-stricken existence in Seville and then in Grenada. On two occasions he so badly managed his affairs that he was put in prison. In 1604 he published the first part of *Don Quixote* which was an instant success. However, it was ten years before Cervantes decided to finish his *Quixote*, by now being read in all parts of the world. The first part was translated into English by 1612 and into French two years later. Today translations of *Don Quixote* have been made in almost every written language including Chinese, Korean, Tibetan, Japanese, Sanskrit, Arabic, Hebrew, and all the languages of Europe. In 1959, no fewer than 2,047 editions of the work existed all over the world in 53 languages (including Dog Latin). A source of inspiration for other literatures, Cervantes's masterpiece has been studied for its bearing on politics, religion, science, criminology, botany, medicine, in short, in every one of its thousand aspects, both comic and tragic. Sancho Panza in no less celebrated than his master. The donkey and the mare have entered the world's lore of famous animals. Ever since

ROMAIN ROLLAND

Romain Rolland's life (1866-1944) spanned a period of social and political unrest, and his works reflect the clashing forces of a changing world: the nineteenth century demands for justice and liberty, the twentieth century's search for communication and human understanding. Rolland's path led him from Tolstoy (with whom he kept up a regular correspondence) to Gandhi, to whom he dedicated a major work in 1923. For twenty years—between 1920 and 1940—he strove to conciliate Occidental and Oriental thought, to reconcile the rejection of tyranny and the doctrine of non-violence. The theme of all his writing is faith in man and in what he called the "grandeur of the world", and nowhere does this resound more clearly than in his vast correspondence. His output of works—plays, essays, novels, polemical writings—was one of the most prolific of his day; all reflect an unswerving belief in the unity of mankind. When he was awarded the Novel Prize for Literature just fifty years ago, Romain Rolland was certainly the best known French writer in Europe. His romantic cycle, *Jean Christophe* (the story of a German musician), was immediately translated into several languages, and earned for him an international reputation. His *Au-dessus de la mêlée* (Above the Battle), written in the midst of World War I, reflected his militant pacifism and added to his prestige as an idealist. Rolland, who was later to write

the lives of Ramakrishna and Vivenkananda, had already become a "guru", as a spiritual teacher is called in India, in the eyes of the Western world. A great lover of music and art, Rolland wrote with intense feeling on Beethoven and Michelangelo.

MEN EVENTS

its appearance, *Don Quixote* has inspired great writers. Samuel Butler's Hudibras, Marivaux's Pharsamond, Wieland's Don Silvio de Rosalia—all are manifestations of "Quixotism". Much of the philosophical and spiritual writings of Miguel de Unamuno are directly influenced by Cervantes and Quixotism. The Melancholy Knight also left a strong mark on music and the other arts, from the seventeenth to the twentieth centuries. *Don Quixote* has unspired a host of operatic composers, from Purcell (1694) to Massenet (1910); Richard Strauss used it as the theme for one of his most beautiful symphonic poems, as did Manuel de Falla in his "Master Peter's Puppet Show". Painters, sculptures and illustrators throughout the world have added their interpretations—William Hogarth, Gustave Dorè, Salvador Dali to name only three. *Don Quixote* has appeared as an American fiilm (1916) and a Soviet film (1957). In 1935, the celebrated Russian base, Chaliapin, sang the role of *Don Quixote* in a film made by the German producer, G.W. Pabst—a cinema opera with music by the French composer, Jacques Ibert. Miguel de Cervantes died 300 years ago on April 23, 1616—on the same day as William Shakespeare.

ISAAC NEWTON

Just three centuries ago, Isaac Newton, a young scholar of Trinity College, Cambridge, pondered a question that was to lead him to one of the most important discoveries in the history of natural science. Was the force which caused objects to fall merely a terrestial phenomenon or was it one manifestation of a great Universal Law ruling all motion throughout space? It took Newton a number of years to prove that there was indeed a universal force, and to work out his full statements on the laws of gravitation, which he eventually published in 1687. Newton first tested his theory by calculating the orbit of the moon, but when his results failed to agree precisely with the moon's observed course he laid aside his research until more accurate figures were obtained for the distance between the moon and the earth. With these figures his calculation of the action of gravitation on the moon corresponded exactly with the moon's course; similar calculations applied to other heavenly bodies completed the chain of evidence.

Newton's discovery of the law of gravitation has tended to overshadow his many other achievements. His contributions to the theory of light were of almost equal importance. Through his experiments he was able to break up white light into the colours of the spectrum and to recombine colours into white light. His studies on light also led him to invent the reflecting telescope. His discoveries in mathematics included a new method of calculus (or, as he called it, "fluxions"). His contributions to science include many of the fundamental laws of the physical world upon which modern physics and mechanics have been developed. Yet this outstanding physicist and philosopher had the modesty of true genius. "If I have seen farther", he once wrote, "it is by standing on the shoulders of giants." And on another occasion he declared: "I seem to have been only a boy playing on the seashore and diverting myself in now and then finding a smoother pebble or a prettier shell than ordinary, whilst the great Ocean of Truth lay undiscovered before me."

GOTTFRIED LEIBNITZ

Mathematician, theologian, historian, diplomat—the German philosopher, Gottfried Wilhelm Leibnitz (1646-1716) was a man of almost universal interests and attainments. At fifteen, already a practised scholar in Greek and Latin, he turned eagerly to the works of modern thinkers—Bacon, Kepler, Galileo and Descartes. At twenty-five his theses on philosophy and law had been accepted, he had studied chemistry, higher mathematics and mechanics and had written several works on theology and politics—two of his lifelong interests. Leibnitz the mathematician invented differential calculus in 1676. As a theologian he sought ways to bridge the schisms of the Christian churches, and on this problem he corresponded for many years with the French prelate, Bossuet. As a diplomat he sent to Louis XIV a memorandum on French relations with Turkey, and drew up for Peter the Great a plan for the Westernization of Russia. As a historian he founded the scientific method of historical criticism. However, it was as a philosopher that he achieved his greatest fame. In 1684 he rejected Cartesianism and elaborated a new theory of knowledge in his *New Essays Concerning Human Understanding*. His *Monadology* (1714) was a complete exposition of his philosophy—the doctrine of the supremacy of intelligence in man and good in the world. Voltaire was later to satirize this doctrine in *Candide* and to ridicule its optimism with the famous phrase, "everything is for the best in the best of all possible worlds".

But optimism has always been a basis of scientific thought and makes Leibnitz more up to date than ever.

RUBEN DARIO

The works of Ruben Dario occupy as honoured a place in modern poetry as they do in the history of Spanish-language literature. Yet despite their wealth of vigour and elegance, they remain too little known outside Spanish-speaking countries. Such is their reputation within those countries that it is often said there are two periods in Spanish-American poetry—"before Dario" and "after Dario."

Ruben Dario was born in Nicaragua in 1867. He lived in Chile, in Argentina and in Paris, and travelled widely in Europe as a diplomat and journalist. With his knowledge of languages and his profound

culture, he recognized the importance of the new literary movements in the Europe of the late nineteenth and early twentieth centuries. Among French poets like Baudelaire, Mallarmé and Verlaine he rediscovered an economy of expression (of which he was already a past master), and their experiments inspired him to breathe new life into Spanish-American poetry, which had still not freed itself from a rather grandiloquent romanticism. He became the leader of a movement, quickly labled *modernisimo*, which gave new accents to the great Spanish classic tradition represented by Cervantes, Lope de Vega and Quevedo. The appearance of each of his works—*Prosas profanas* (Profane prose) in 1896; *Cantos de Vida y Esperanza* (Songs of Life and Hope) in 1905; *El Canto Errante* (The Wandering Song) in 1907 and *Poema de Otoño* (Autumnal Poem) in 1910—was hailed as a major event in Spanish-speaking countries. Today, fifty years after his death, the reputation of the great Nicaraguan poet continues to grow.

BOOKSHELF

ARCHAEOLOGISTS AT WORK

■ **The Desert Kingdoms of Coastal Peru.**
By Victor W. von Hagen.
Well documented and readable description of the remarkable Mochica-Chimu civilization (see article page 10). Nearly 160 illustrations and drawings.
George Weidenfeld and Nicholson Ltd., London, 1964 (63/-); New York Graphic Society Publishers Ltd., Greenwich, Connecticut, U.S.A., 1965 ($10.00).

■ **Archaeology & the Microscope.**
By Leo Biek, with a forward by Sir Mortimer Wheeler.
The man in the trench and the scientist at his bench working together.
Lutterworth Press, London, 1963 (45/-).

■ **Science in Archaeology:**
Comprehensive survey of progress and research.
Edited by Don Brothwell and Eric Higgs.
595 pages. Basic Books, New York, 1963 ($17.50).

RECENT UNESCO BOOKS

■ **Social Research and Rural Life in Central America, Mexico and the Caribbean Region.**
(Technology and Society series), 1966 (18/-; $3.50).

■ **Business Management.**
By Roger Grégoire.
(The University Teaching of Social Sciences series), 1966; (12/6; $2.50).

■ **A Survey of the Teaching of Physics at Universities.**
(The Teaching of Basic Sciences), 1966 (23/-; $4.50).

★

■ **Asia in the Making of Europe. Volume I: The Century of Discovery.**
By Donald F. Lach.
The first in a series of volumes which will trace, century by century, the role of Asia in the development of Europe.
Published in two books by the University of Chicago Press, Chicago and London, 1965 (144/-; $20.00).

■ **World Understanding: A Selected Bibliography.**
Compiled and edited by Alice H. Flynn.
Published for the United Nations Association of the U.S.A. by Oceana Publications Inc., Dobbs Ferry, New York, 1965.

■ **No Easy Walk to Freedom.**
Articles, speeches and trial addresses by Nelson Mandela.
A first-hand report of the struggle against Apartheid.
Basic Books, New York, 1965 ($4.95).

■ **British Secondary Education: Overview and Appraisal.**
Twenty-three British educators tell the story of their secondary schools.
Oxford University Press, London, 1965 (30/-).

From the Unesco Newsroom...

Television lessons for Africa

New adult education techniques are being devised and tested in Senegal, where a series of experimental television programmes which could influence mass education and literacy teaching throughout Africa are being produced by a team composed of 18 Senegalese, a New Zealander and a Frenchman. This six-year pilot project is financed by Senegal and Unesco, and Canada is providing some $63,000 in bilateral aid.

'Lost city' discovered in Peruvian jungle

Ruins of a "lost city" dating from the time of the Incas have been discovered by the American explorer Gene Savoy, near Pataz (Peru) in a jungle on the eastern slopes of the Andes. Scattered over some 12 square miles, the city has well-built roads, stairways and terraced temples decorated with gargoyle heads and other signs of a once flourishing civilization. According to the explorer the city could have been built by a tribe called the Chachapoyas who took refuge in the jungle after their defeat by the Incas in the 15th century. Certain archaeologists believe that this new find may be even more important than the discovery of the famous ruins of Machu Picchu in 1911.

Harvesting rain in the desert

Technicians at the U.S. Water Conservation Laboratory believe they have found how to harvest much of the rain that falls in desert storms—by spraying a water-repellent silicone compound on the sand. This holds the rainfall above ground where it can be gravity-drained into reservoirs. Yield from a half-inch rainfall on a "siliconed" plot of desert land proved to be 93%. The problem which still remains is how to make the silicone crust permanent.

Confusing names in medical terminology

Present confusion in medical terminology can cause potentially dangerous misunderstanding. Some diseases have ten or more names, even in the same language, and at least one, myelofibrosis (a bone marrow disorder) is known by at least 30.

PUZZLE PHOTOS IDENTIFIED

All photographs on pages 8 and 9 except one show equipment used in nuclear research at CERN.

1. NOT A JET PLANE WHEEL — This highly-polshed circular metal cap tops an electrical condenser charged to 300,000 volts, and reduces the amount of electricity discharged into the air.

2. NOT EQUIPMENT FOR AN ATOMIC SCIENTIST — The spidery wheels of a sophisticated garden rake. They would be of no use to a physicist, but gardeners on large estates find them a big help in collecting leaves and grass cuttings.

3. NOT A TROMBONE OR A LASER — A deflector of nuclear particles in a giant accelerator. A pulse of electricity causes a beam of particles projected by the accelerator to be diverted on to a target of atomic nuclei for an infinitesimal second (200 microseconds).

4. NOT AN ARMY TANK — Construction of a "bubble chamber", a device for observing the behaviour of nuclear particles. No microscope is powerful enough to view nuclear particles. Scientists have therefore devised various methods of "seeing" the tiny world within the atom. One of these is the bubble chamber containing a liquid (often liquid hydrogen), which is suddenly decompressed and made to "boil". Particles leave a trail of bubbles when projected into the chamber. This bubble chamber is one of the two largest in the world. Last year 1,600,000 photographs of particle interactions were taken during six experiments with bubble chambers at CERN.

5. NOT A HULA HOOP — Physicist checks the starting point of a giant particle accelerator. The rings he is inspecting are the source of electrically charged atoms (called ions) which supply the infinitely tiny projectiles that are used to bombard the nucleus of the atom.

6. NOT AN OUTSIZE GAS RANGE BURNER — These objects are components of an electromagnet used for testing conductive properties of different materials. Twelve of these "pancakes", as they are called from the flat, spirally wound centre section, are used in the electromagnet. The twelve arms are water circuits for cooling.

An international group of specialists convened by the Council for International Organizations of Medical Sciences (founded in 1949 under Unesco and WHO auspices) has now suggested how this chaotic situation could be cleared up. It proposes the setting up of an international clearing house for medical terminology and lexicography which would study problems of medical language, prune from it unnecessary words and adopt internationally acceptable terms and definitions.

Monument you can listen to

An unusual type of monument is to be built in Geneva to commemorate the centenary of the International Telecommunication Union. It will consist of two concrete discs, 36 ft in diameter lined with titanium screens, and a footbridge passing between them. Persons crossing the bridge will find themselves in an acoustic zone with unexpected qualities. All sounds in this area will set up prolonged reverberations as they are reflected back and forth between the discs time and again. The Soviet design was chosen by an international jury which considered 211 entries presented in the design competition for the centenary monument. The jury also awarded prizes to entries submitted by teams from Switzerland, Poland and Yugoslavia.

World survey of deep sea tides

A plan to turn the oceans into a laboratory for the study of deep sea tides and their effect on such global phenomena as the deforming of the earth by lunar and solar attraction has been endorsed by the 54-nation Intergovernmental Oceanographic Commission. The idea was proposed by the International Association of Physical Geography. The survey would begin with tidal observations at about 300 points on the ocean floor, and the whole operation would last from five to ten years.

Flashes...

■ *San José, capital of Costa Rica, has named one of its avenues "Avenida de la Unesco".*

■ *The University of Papua, at Port Moresby, South East New Guinea, will receive its first students next year.*

■ *Jets of water under very high pressure are being used in the mines of the Donbass in the U.S.S.R. to cut anthracite, an extremely hard type of coal.*

■ *A museum dedicated to Paul Gauguin (1848-1903) has been opened near Papeete in Tahiti, where the painter spent the last eight years of his life.*

■ *The Red Cross is setting up a centre for study, research and training in Geneva. It will be called the Henry Dunant Institute after the founder of the Red Cross.*

■ *Over 8,000 newspapers in 44 languages were published in India in 1964, reports the India Press Registrar. Of 514 dailies registered, the largest language group was Hindi with 149 papers, followed by Urdu, 68 and English, 56.*

WORLD PANORAMA OF HIGHER EDUCATION

Did you know that:

■ Asia has the highest number of students in higher education in the world?

■ Europe has the largest number of institutions of higher education in relation to population?

■ North America is not expanding in higher education as fast as other continents, but has more students enrolled than several of the other continents combined?

■ Africa has had the highest percentage increase in higher education enrolment during the last decade?

These striking facts are revealed in a new Unesco publication, Volume IV of the World Survey of Education, which gives a global picture of higher education based on reports and statistics from 200 countries (1).

This monumental 1,433-page reference work offers a country by country survey with detailed facts and figures and an analysis of the evolution and present status of higher education together with its trends and problems. It takes a broad, purposeful look at general trends in higher education, analyzing its progress since 1930, its changing pattern, its intellectual and human aspects and its plans and perspectives.

The speed of change in higher education, it reports, is higher than at any other level of education. Taking a sample of 39 countries it shows that between 1930 and 1960, student enrolment rose from about 2.6 million to 9.2 million (an annual increase of 10 %).

Some of the individual country increases during this period were spectacular: Iraq, 212 %; Thailand, 157 %; Puerto Rico, 39 %; United Arab Republic 34 %; India 31 %; Argentina 22 %; and Yugoslavia 18 %. And the survey makes it clear that we are in the early stages of a process of growth that has still far to go.

Other important developments reported by the world-wide survey show that:

■ Higher education enrolment in the U.S.S.R. roughly trebled between 1930 and 1950 and then doubled by 1960.

■ India's university enrolment increased by 250 % between 1950 and 1960, and under the new five-year plan is expected to reach one million; in the Phillippines one third of a million students are now enrolled.

■ The proportion of science and technology students increases yearly: while world university enrolment rose by 50 % between 1950 and 1960, enrolment in colleges of technology outside the universities increased by 200 %.

■ Today's "explosion of knowledge" makes it difficult for scientists to keep abreast of developments even in their own specialities: the physical and biological sciences alone publish 70,000 scholarly journals annually.

■ Progress in specialization paradoxically makes the specialist even more dependent on matters that seem far removed from his own field. For instance a crystallographer is now asked to apply his expertise to chemical, biological and historical problems.

■ By 1962 the proportion of post graduate students in science and technology had risen to 20 % of the whole in United Kingdom universities; in Soviet universities and institutes of technology as much as 10 % of undergraduate students do part-time research on projects being carried out by their teachers.

■ Italy admitted women to its universities as students and teachers as early as the 13th century, but it was not until the 19th century that universities began to open their doors to women on an appreciable scale. In most countries today the proportion of women students varies from one-third to one quarter.

■ Three-quarters of Soviet doctors and 30 % of engineers are women, and half of all Soviet "executives and specialists" are women.

■ The American college and university has always welcomed the presence of students from foreign countries. In 1961-62 roughly 57,000 students from other countries were enrolled in institutions of higher education in the United States, and approximately 20,000 foreign students received degrees from American universities during this academic year.

■ In France, 80,000 students out of a total of 215,000 are concentrated in the University of Paris.

■ Sweden estimates that the demand for civil engineers for industry alone will rise from 89,000 in 1960 to 183,000 in 1970.

Volume IV of Unesco's World Survey of Education completes a cycle of global education surveys which began in 1955. Earlier volumes were: Volume I, National Educational Systems; Volume II, Primary Education, and Volume III, Secondary Education.

(1) World Survey of Education, Vol. IV, Unesco; $33.00; £8.50; 115 F.

Letters to the Editor

TO VANQUISH HUNGER

Sir,

I have just begun to earn my living and I would like to give Unesco part of my first salary to help in the fight against hunger now being waged in the developing countries. I find each issue of the Courier passionately interesting, particularly the articles on social questions and on science and the arts.

Hélène Leval
Paris, France

Fifteen Unesco Gift Coupon projects offer readers a wide choice of ways in which to help the world-wide FAO Freedom from Hunger Campaign. Details of projects and Gift Coupons to the value of whatever sum readers wish to donate can be obtained from: Council for Education in World Citizenship, 25 Charles St., London W.1, U.K.; Unesco Gift Coupon Office, Room 2201, U.N. Building, New York 17, N.Y., U.S.A.; U.N.A. Committee for Unesco, 329 Bloor St. West, Toronto 5, Canada—Editor.

THOSE MAGNIFICENT MEN IN THEIR FLYING MACHINES

Sir,

The gallant epic of the men who pioneered aviation is known to everyone. Don't you think that many readers would be delighted to find articles on the birth and the dynamic progress of aviation in your magazine? And what about the future of aeronautics? Surely this is a subject that would interest every reader.

Christian Delannes
Brussels, Belgium

DEATH ON THE ROADS

Sir,

In your December 1965, issue, appears an item which might be wrongly interpreted. Under the title "Death on the Roads", you quote the U.S. statistic, 40,000 deaths in 1962, in a way which would seem to indicate that the U.S. death rate from highway accidents has sharply increased in recent years.

The annual U.S. highway death toll has remained more or less stationary at about 40,000 until very recently despite increasing population, increasing numbers of vehicles, and sharply higher mileage travelled. I understand that the experience of France in the first nine months of 1965 has attained the same level, proportionate to its population, although the French vehicle and mileage statistics are lower. Unfortunately, I understand that the U.S. figure has begun to climb again.

However, the sense of the paragraph, that the accident rate is climbing sharply in many countries, is certainly true. This reflects growing affluence in Europe as well as the beginnings of road transport and increasing numbers of private vehicles in the developing countries.

With the growth of experience and discipline among the hordes of new drivers, the construction of their highways to safer standards, the accident rate on a mileage basis will very likely decline. However, the tragic figure, the total number of deaths, will undoubtedly continue to climb.

Drastic solutions—a reduction in the power and size of private automobiles, long overdue in the U.S.; prohibition of automobiles within the hearts of our cities; new transportation systems allowing a reduction in mileage and vehicles—will ameliorate the problem and bring it eventually within tolerable limits.

Stanley I. Hart
Paris, France

MASTERPIECE FROM DAHOMEY

Sir,

When I received the December issue (Arts of Africa, Oceania and America) I was absolutely stunned by the double-page photograph of the Dahomey statue. I know the Paris Musée de l'Homme rather well, but I have never before seen this particular statue, which is no miracle at all as the museum is so richly endowed that people should spend months and even years to discover all its treasures. I am full of enthusiasm about the work of art itself and the impeccable reproduction.

Rosemarie Kirschbaum
Basel, Switzerland

A PLACE BY ANY OTHER NAME

Sir,

Unesco's headquarters in Paris is situated in the Place de Fontenoy. I learn from my encyclopedia that Fontenoy is "a Belgian commune, city ward of Tournai. Scene of the battle on March 11, 1745, in which the French army of Marshal Saxe, watched by King Louis XV, vanquished the forces of England and Austria..." That Unesco's address should evoke a battle in my view is inconsistent with the basic task of the organization —to work for international harmony. Would not the name of a great figure —a Nobel Peace Prize winner such as Dr. Schweitzer, for example—be just as satisfying to our national pride and surely a far more appropriate way of identifying the "Unesco Place"?

Henri Boularrand
Carnoux-en-Provence
France

ART PLUNDER DOWN THE AGES

Sir,

Recalling your issue on *Art Thieves* (November 1965), it may be worthwhile to mention that already from the beginning of history kings and warlords have taken away works of art by force.

Prof. E. A. Speiser (who died recently) relates in *Mesopotamia—Evolution of an Integrated Civilization:*

"The Elamite ruler Shutruk-Nahunte invades Babylonia some time before the middle of the 12th century and despoils its major centres of such priceless treasures as Naram-Sin's Stele of Victory, and Hammurabi's famous law code stele, among many others. All were to be eventually recaptured in Susa by the far-reaching arm of archaeology." They are now in the Louvre. (Cited from *The World History of the Jewish People, Volume I. "At the Dawn of Civilization"*; Jewish History Publications Ltd—W.H. Allen, London 1964).

At the end of World War II in Paris the Nazis tried to rob the most famous paintings of French Art and to transfer them to Germany, as has been presented in the extraordinary film "The Train". And these are only two examples of many.

Dr. Albert Baer
Kiryat Bialik
Israel

The article "Thief-Proofing our Art Museums" did not deal in any way with the problem of art plunder through the ages which is a totally different subject—Editor.

CULTURES WITHIN CULTURES

Sir,

A reader from Barcelona (Feb. 1965) suggested that more attention be paid to the cultures of the smaller national groups, especially those which are minorities within a larger nation. May I support this plea by adding that many of the smaller linguistic and ethnic groups have cultures which are both interesting and lively, but that they often find it hard to maintain their identity even where native expression enjoys perfect freedom. Your correspondent mentioned the Basque, Catalan and Galician cultures of Spain which exist in addition to the better known Castilian.

The United Kingdom has several languages **apart from** English. These are Welsh, Scots Gaelic, Manx and the French patois of Channel Islands. Both the Isle of Man and the Channel Islands have their own ancient parliaments. Wales has founded an international *eisteddford*—a competitive festival of folk song and dance, and this colourful festival attracts groups from many countries. The *eisteddfod* is a Welsh literary and musical institution which has its origins in the Middle Ages, and the international *eisteddfod* is its modern extension, open to the whole world. I feel certain that many readers would welcome accounts of activities of this kind, and that the Courier is the appropriate vehicle for them.

G. Illtyd Lewis
Swansea, Wales

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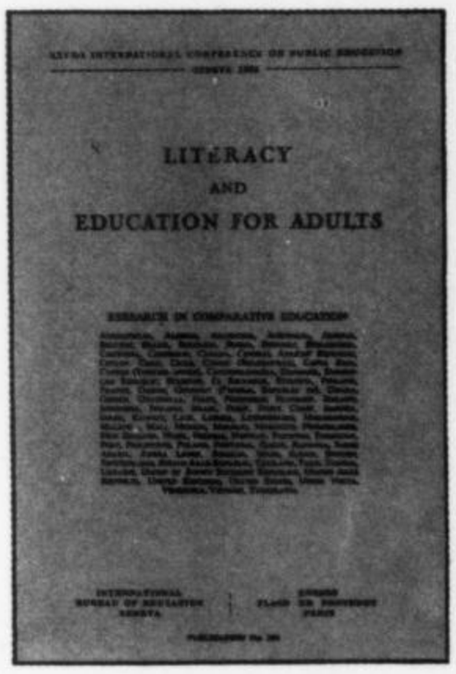

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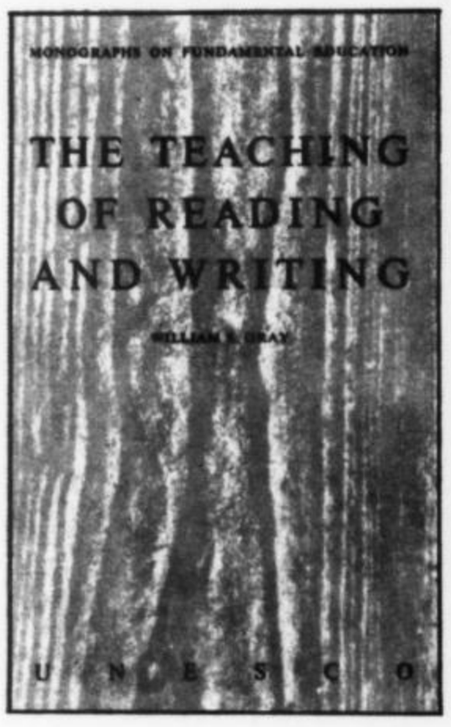

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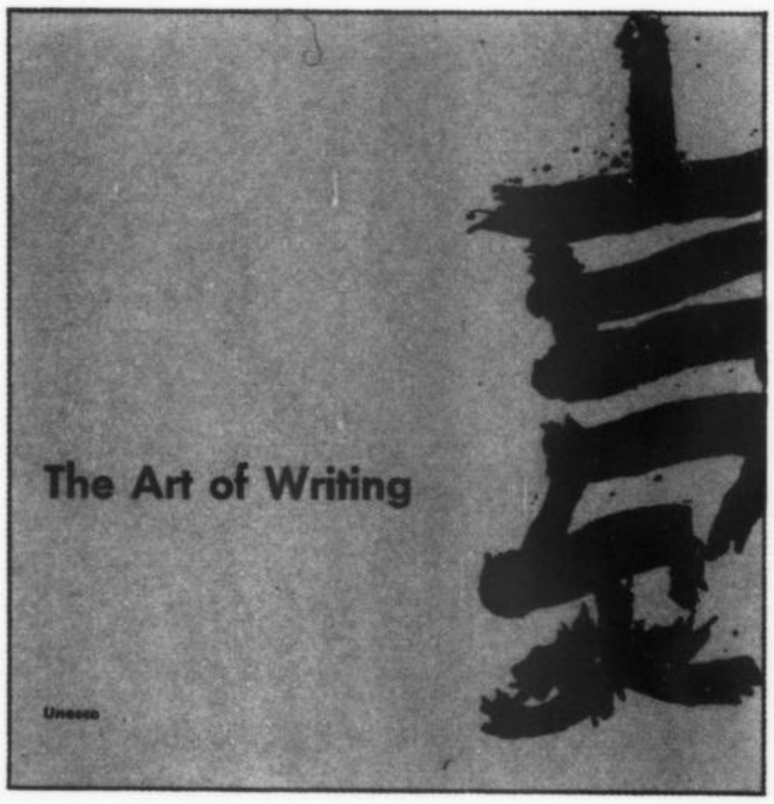

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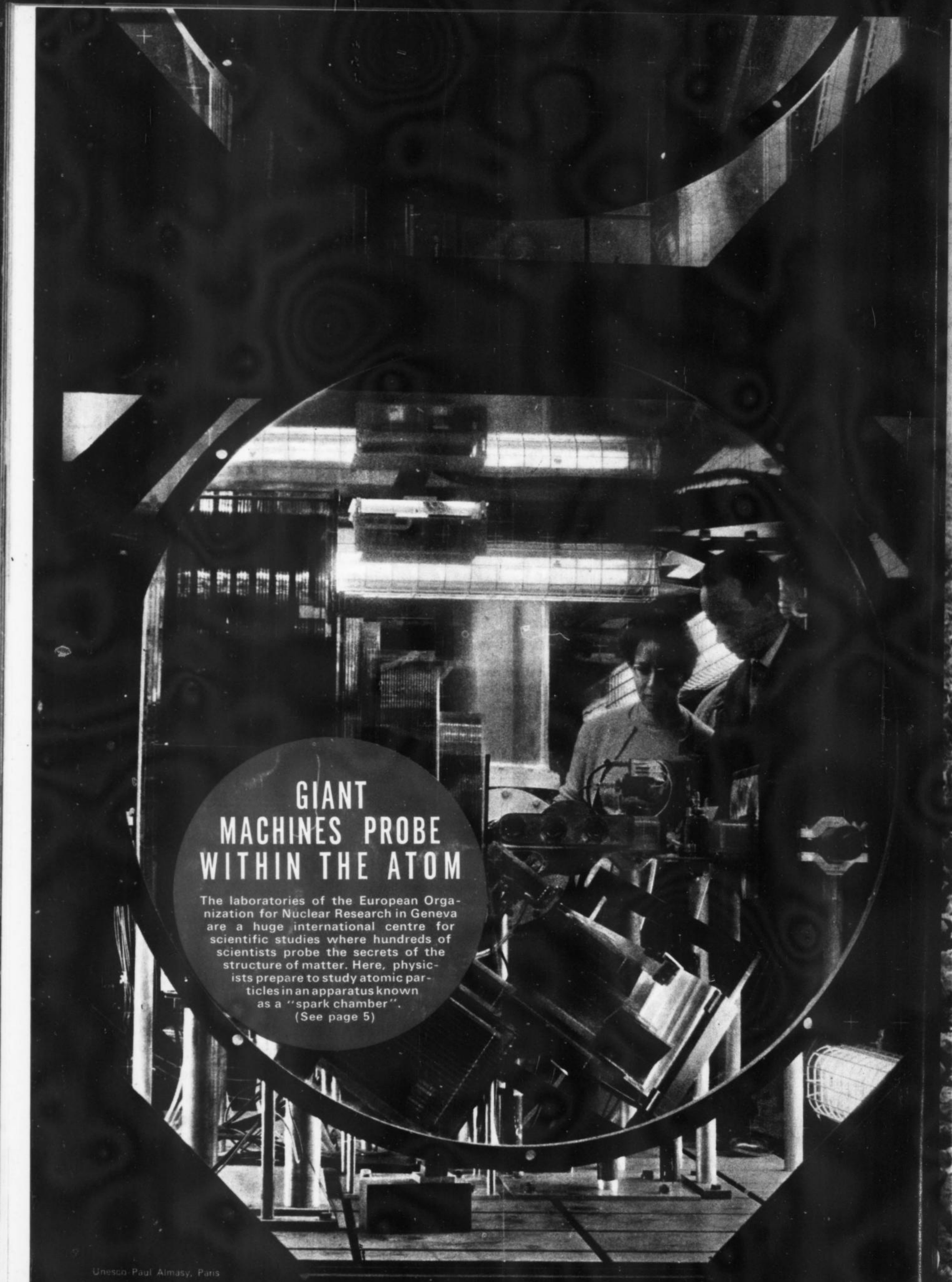

GIANT MACHINES PROBE WITHIN THE ATOM

The laboratories of the European Organization for Nuclear Research in Geneva are a huge international centre for scientific studies where hundreds of scientists probe the secrets of the structure of matter. Here, physicists prepare to study atomic particles in an apparatus known as a "spark chamber".

(See page 5)

Unesco-Paul Almasy, Paris